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Volume XXVIII FEBRUARY, 1919 Number 2

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Entered as second-class matter May 22, 1913, at the postoffice at Chicago, Ill., under the Act of Congress, March 3, 1897.

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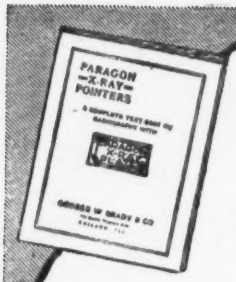

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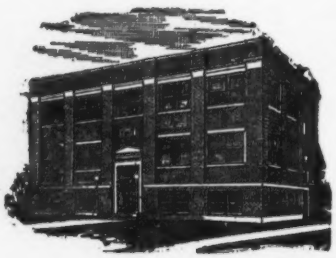

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AN INTERNATIONAL MAGAZINE, PUBLISHED MONTHLY

VOLUME XXVIII FEBRUARY, 1919 NUMBER 2

THE CLINICAL SIGNIFICANCE OF CONGENITAL ANOMALIES OF THE KIDNEY AND URETER

WITH NOTES ON THE EMBRYOLOGY AND FŒTAL DEVELOPMENT OF THE KIDNEY

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A COMPREHENSIVE knowledge of the embryology of a given species, human or otherwise, is necessary before one can arrive at definite conclusions concerning the cause of anomalies of development in individuals of the particular species. In this paper, therefore, we shall endeavor first to give a brief outline of the development of the organs of the upper urinary tract in the human, and then to trace the relationship between this and the various anomalies which have been noted.

A bibliography, together with a brief summary of some of the published observations, is appended.

In the development of the kidney we are concerned with the growth of three definite and distinct organs, which are formed at different stages in the growth of the embryo. These organs are known as the pronephros, the mesonephros, and the metanephros. The first two degenerate, while the third remains as the permanent kidney. It so happens that the second begins to develop while the first degenerates, and the third begins to develop as the second degenerates, so that both a constructive and a destructive process is going on at the same time.

The pronephros carries on an excretory function during its existence, but there is some discussion as to whether the mesonephros exercises a similar function. Some observers believe that it has not such a function, but that it may be active in some other way. It is known, however, that it does form the beginning of the metanephros and of the reproductive apparatus. The metanephros goes on to complete development, and is the active excretory organ at birth.

PRONEPHROS

The first anlage of the pronephros consists in the pronephric tubules. Each primitive segment stalk throughout the body cavity produces a pronephric tubule, which is composed of a principal tubule, a pronephric chamber, nephrostome canal, and an internal and external glomerulus. By the union of these pronephric tubules a collecting duct or an excretory duct is formed, running the entire length of the body cavity. The development of the pronephric tubules is divided into two portions: first, the development of the pronephric tubules and the collecting duct; second, the development of the terminal portion of the primary excretory canal.

The first anlage of the glandular portion occurs in an embryo 1.73 millimeters in greatest length. The development goes on so quickly that when the caudal portion is developed in an embro of 2.5 millimeters the cranial sac is beginning to dissolve, so that as the lower portion develops the upper portion degenerates. In an embryo of 4.25 millimeters vertex-breech length, the degeneration of the pronephros is well advanced, but the time of its complete disappearance cannot be definitely stated, since it extends into the territory of the mesonephros. This takes place approximately when the embryo is 4.9 millimeters in its vertex-breech length.

The blood supply of the pronephros is derived from a ventral arch system which is divided into two groups, a cranial group of aortic arches, and a caudal group of originally pronephric arteries.

MESONEPHROS

The mesonephric tubules develop from the same parent tissue as the pronephros, that is, the stalks of the primitive segment, and they make use of the same efferent canal, the primary excretory duct. The principal tubules of the mesonephros, however, usually arise more mesially than those of the pronephros.

The mesonephric anlage begins to develop from the nephrogenic cord which arises from the primitive segment stalks, cut out, as a whole, from the mesoderm in an embryo of 2.5 millimeters greatest length. Eight mesonephric vesicles form anteriorly and posteriorly. As the embryo increases in length, the oldest tubules gradually take on various changes in shape, until at 9.5 millimeters greatest length they are complete. In an embryo of this length there are 32 to 34 tubules, consisting of malpighian corpuscle and a secreting and a collecting tubule. In an embryo 19.4 millimeters vertex-breech length, they separate from one another and, as a result of the curvature of the excretory duct, become stronger in order to reach the mesially placed bladder. The malpighian corpuscles are pressed together, and the collecting duct of one tubule may serve as the efferent for several. As a further result of the bending of the excretory duct, the orifices of several collecting ducts unite to form a single one.

The degeneration of the mesonephros occurs in two periods. The first begins as soon as the growth cranially is complete, that is, in an embryo 5.3 millimeters in length, and is finished in an embryo of 21 millimeters greatest length. During the process, the greatest part of the mesonephros at the cranial end is degenerated. The second period comes on so gradually that definite time limits are not possible for it. Within this period there occurs a new suppression of tubules and a selection of those that will enter the service of the reproductive system, and of those that will persist, even in the adult human organism, as the *paragenitalis*. In animals without a metanephros this latter or lower portion becomes the actual functionating kidney. Estimated by tubules, 57 are degenerated out of a maximum of 83 that develop. The corresponding portion of the excretory duct disappears along with the tubules. From the stage of 21 millimeters greatest length onward, all embryos show a rather constant number of mesonephric tubules in the lumbar segment, but these are almost all broken in one or several places. The first mesonephric arteries are formed in an embryo of about 5.3 millimeters in length. They arise from the lateral surface of the aorta, pass to the malpighian corpuscles and terminate in these with an enlargement, assuming a spherical shape. The arteries are not paired. In the cranial segment one artery may lie in each segment or in two or three segments, but in the caudal segment the arteries become more numerous. From the sixteenth thoracic to the third lumbar all the mesonephric arteries persist, and from these are formed the phrenic, suprarenal, accessory renal, internal spermatic, accessory spermatic, and also the branches to the lymph nodes and sympathetic ganglia in the region between the superior and inferior mesenteric arteries.

METANEPHROS

The metanephros may be divided, embryologically, into two portions, the secretory or glandular portion, and the efferent appara-

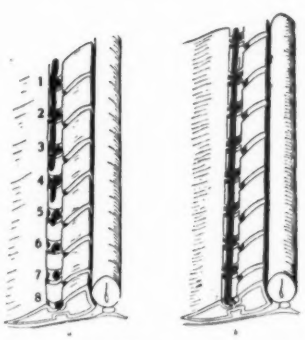

Fig. 1.

Fig. 1. Diagram of the development of the pronephros. *a*. The principal tubules, *5*, *6*, *7*, and *8*, develop by evagination from the parietal mesoblast of the primitive segment stalk. They grow caudally (*3* and *4*) and reach and overlap the succeeding tubules, passing laterally to them (*2*). The principal tubules, which are thus brought into apposition, fuse, and a collecting duct (*1*) is formed. *b*. The collecting duct remains in connection with the various segment stalks by means of the principal tubules. (From Keibel and Mall, *Human Embryology*.)

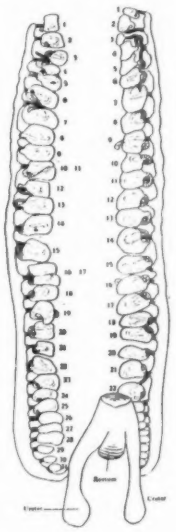

Fig. 2.

Fig. 2. Model of the mesonephroi, the metanephroi and the bladder of a human embryo of 7 millimeters greatest length. The mesonephroi have a perpendicular position and the individual tubules are at sufficient distances, so that the malpighian corpuscles lie in a single row. The lowest tubules are still developing, but have already united with the excretory duct. The fully developed canals are S-shaped. Most ventrally are the malpighian corpuscles, in the middle is the secreting tubule, and most dorsally is the collecting tubule. The loop formed by the secreting and collecting tubules usually has not yet reached the medial border of Bowman's capsule. The whole coil of a mesonephric segment (Malpighian corpuscle and the two tubules) lies still in one horizontal plane. (From Keibel and Mall, *Human Embryology*.)

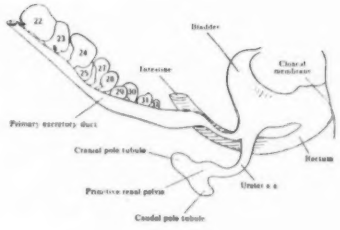

Fig. 3.

Fig. 3. Model of the bladder, primary excretory duct, and ureter of an embryo of 9.5 millimeters greatest length.

The common portion by which the primary excretory duct and the ureter open into the bladder is enlarged and is more sharply differentiated from the wall of the bladder. The ureter has differentiated into the primitive renal pelvis and the ureter segment stalk. The two pole tubules are beginning to grow out from the primitive pelvis. (From Keibel and Mall, *Human Embryology*.)

tus. We will first consider the latter, namely, the ureter, the renal pelvis, and the collecting tubule system, all of which develop from the primary excretory duct.

The anlage of the ureter arises as a hemispherical outgrowth of the primary excretory duct, in an embryo sometimes between the stages of 4.5 millimeters and 5.3 millimeters total length. The short ureter grows at first dorsally, toward the vertebral column, but later, in an embryo of 8.5 millimeters and 9.5 millimeters greatest length, it forms a curve which becomes gradually flatter, and the ureter grows cranially. When it gains the dorsal surface of the mesonephros, it lies in the retroperitoneum, surrounded by loose mesochyme. Here radial outgrowths of the collecting tubules take place, and the definite position of the renal pelvis is reached, in an embryo 9.5 millimeter to 13 millimeters greatest length, at the level of the second lumbar vertebra. While the ureter is still in the period of outgrowth the primitive pelvis elongates in the craniocaudal direction and thus acquires its poles, both of which grow out in opposite directions, and so begin the formation of the collecting tubules of the first order. Later horizontal tubules develop, corresponding to the middle of the renal pelvis, one directed ventrally and the other dorsally. These four primitive tubules become enlarged at the blind ends to the so-called ampullæ. From the various angles of the ampullæ secondary collecting tubules grow out parallel to the future surface of the kidney. When they attain a certain length they develop ampullæ, from the various sides of which tertiary tubules are formed, and so the process goes on up to the formation of the terminal collecting tubules. The formation of new collecting tubules ceases at the fifth month. The entire ureteric tree spreads

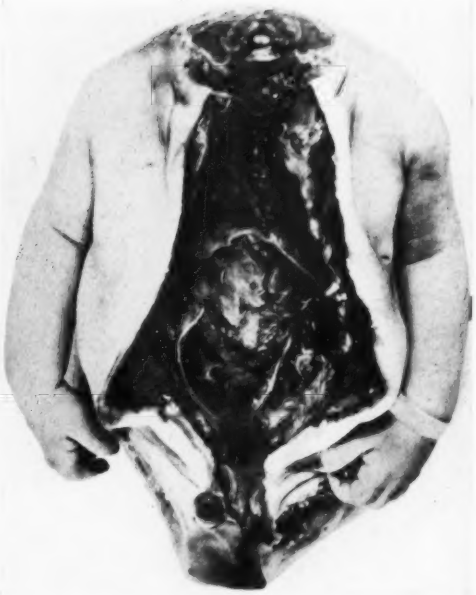

Fig. 4. Horseshoe kidney. This specimen was obtained from a full-term male infant which was stillborn. It is typical of this type of fused kidney, being united by a bridge of normal renal tissue at the lower poles. On the left side there is one ureter which divided into three portions as it enters the pelvis. On the right there are two ureters, the upper one collects the urine from the lower pole and bridge. These ureters enter the wall of the bladder separately, but have a common orifice in the trigone.

in a fan-like manner, giving as much room for growth as possible, resulting in abundant branches at the periphery and scanty at the center. Some of the tubules are compressed in growth, and are later taken up in the pelvis. An embryo of 10 millimeters greatest length has two pole tubules in process of formation, and one of 11.5 millimeters greatest length shows anlagen of the central tubules.

The secretory or glandular portion of the metanephros is derived from a group of cells known as the metanephrogenic tissue, which accompanies the ureter in its ascent, and which always covers the primitive renal pelvis. The metanephrogenic tissue has its origin in the metanephrogenic cord, which arises from the mesoderm. The tissue breaks up into as many parts as there are collecting tubules, and covers the surface and sides of these. It is at first a thin structure, but rapid cell multiplication goes on and it becomes denser. Each ureteric tree and its nephrogenic cap is known as a malpighian pyramid. These pyramids are pressed together and unite to form a single investment over the entire kidney. The lines along which the metanephrogenic tissue passes down from the surface beneath the various pyramids are marked by grooves which limit the area occupied by each pyramid, and thus a somewhat lobulated structure is formed. There are at first four pyramids, two pole pyramids and two central ones corresponding to the central tubules. These primary pyramids divide into secondary pyramids, and these, in turn, give off subordinate pyramids, and thus a finer lobulation takes place.

The uriniferous tubules are formed from a compressed mass of metanephrogenic tissue which is formed between the old and young tubule that has just been given off. In this mass a lumen, situated eccentrically, appears and converts the sphere of cells into a metanephric vesicle. The peripheral wall of this vesicle is the thinnest, and from this the entire uriniferous tubule, with the exception of Bowman's capsule, is formed. The wall towards the pelvis, or the central wall. forms Bowman's capsule. This anlage of the uriniferous tubule unites with the young collecting tubule, their lumina being continuous. As soon as this union takes place the former assumes an S shape. The lower limb of the S extends from Bowman's capsule, while the upper limb connects with the collecting tubule. The failure of the uriniferous tubule and the terminal collecting tubules to unite is said to be the cause of congenital cystic kidney.

The malpighian corpuscle begins as a shell-like form, becoming gradually spherical in an embryo 19.4 millimeter, and is complete in an embryo 28 millimeter greatest length. An evagination forms at a point where a portion of the tubule becomes continuous with Bowman's capsule. This evagination increases in size, and the lateral wall of the sphere grows toward it, so that the wide entrance into the shell-like cavity becomes converted into a natural opening through

Fig. 5. Horseshoe kidney. This specimen was obtained from a stillborn female infant at eight months. The lower poles are united by a bridge of tissue which extends well down over the brim of the pelvis, and lies opposite the bifurcation of the aorta. The pelves are not continuous. There are two ureters from the right kidney. one from the upper portion and the other from the lower portion and part of the bridge. They pass over the anterior surface of the kidney and run a parallel course to unite in the wall of the bladder, for there is a common orifice in the trigone. From the left kidney there is a single ureter which passes over the anterior surface of the kidney, and takes its normal course to the bladder.

Fig. 6. Sigmoid kidney. This specimen was obtained from a stillborn female infant near term. The mass of kidney tissue made up of both the left and right kidneys, lies on the left side. The upper pole is opposite the first lumbar vertebra, and the lower pole is in the true pelvis. The pelves are not continuous. The pelvis of the upper kidney is normally placed and the ureter takes a normal course downward and enters the left side of the bladder. The pelvis of the lower kidney is anterior, as this kidney did not rotate. The ureter lies on its anterior surface, crosses over to the right side, and enters the right side of the bladder. The trigone is normal. It will be noticed that both suprarenals are in their normal position.

which the vasa afferens and efferens find ingress and egress. The vascular and urinary poles of the malpighian corpuscles lie opposite to each other.

The development of the cortex begins with the formation of the first generation of the uriniferous tubules, and its increase in thickness depends in the first place upon the new formation of additional tubules, and in the second place on the growth of those already present.

The medulla begins to form after the formation of the definitive renal pelvis. Its increase in length and thickness is due to an increase in the diameter of the individual collecting tubules. During fœtal life it is the medulla that grows principally. After birth a cessation of the growth of the medulla occurs, and continues until the seventh year, during which period the diameter of the cortex increases rapidly. After the seventh year both the cortex and the medulla develop equally.

CAPSULE

Embryonic connective tissue surrounds the growing ureter, the outgrowing tubules and the metanephrogenic tissue from the beginning. But this is not considered a capsule until it can be separated from its adjacent structures, which is at first distinctly seen in an embryo of 70 millimeters greatest length.

Fig. 7. Congenital hydronephrosis. This specimen was obtained from a stillborn infant at term, and showed a very much distended abdomen at autopsy. Before examination a diagnosis of fœtal ascites was made. Section showed that there was a distended cystic tumor lying behind the peritoneum, which contained 400 cubic centimeters of fluid. The upper portion of the wall of this cyst is made up of the thinned out cortex with its fœtal lobulations. The pelvis is divided into two portions, the smaller one is continuous with the ureter; which presents an occlusion at the point of union. This ureter varies in size, and enters the bladder in its normal relation. The right kidney is a typical congenital cystic kidney.

CHANGE IN THE POSITION OF THE KIDNEY

At 7 millimeters in length the renal bud lies opposite the second sacral vertebra, and its pelvis looks anteriorly. At 10 millimeters the upper border of the kidney is at the brim of the pelvis, and at 14 millimeters the upper pole is at the third lumbar vertebra. At 16 millimeters the kidney has passed the second lumbar line and has rotated 90° on its long axis, so that the pelvis is lateral to the ureter and points toward the vertebral column. At 20 millimeters the ureter and kidney are in their relatively normal position. Felix says that during the first half of fœtal life the craniocaudal diameter of the kidney corresponds approximately to the first three lumbar vertebræ. In the second half the cranial pole lies at the level of the eleventh rib, and the caudal one descends to the upper border of the fifth lumbar vertebra.

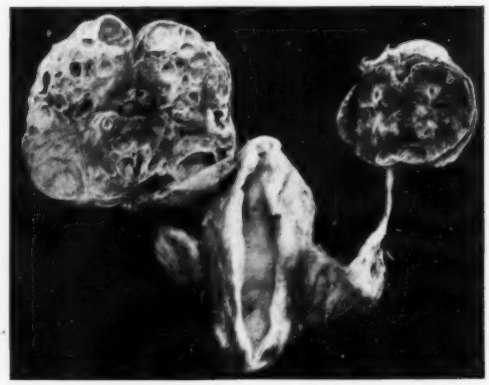

Fig. 8. This specimen was obtained from a stillborn infant at birth. It shows a stricture at the vesical neck, hypertrophied bladder, dilated ureters, torsion of the ureters at the lower third on the left side and upper third on the right side with partial cystic degeneration of the kidneys.

RENAL ARTERIES

The renal arteries are not new formations, each being formed from a mesonephric artery. The kidney climbs upward to the mesonephric arteries, and as soon as sufficient blood supply is assured, the caudal branches separate from it. When the kidney has acquired its definite position it possesses several renal arteries, one of which becomes greatly enlarged to form a definite artery, while the others degenerate or persist as accessory renals. The definite renal artery is either the last vessel of the second group or the first of the third group of mesonephric arteries. In an embryo of 26 millimeters greatest length the arrangement of the arterial apparatus is acquired.

ABNORMALITIES OF THE KIDNEY CONSIDERED AS TO THEIR NUMBER, FORM AND POSITION

There may be complete absence of one or both kidneys. In such a case the anlage of one or both failed to bud off from the excre-

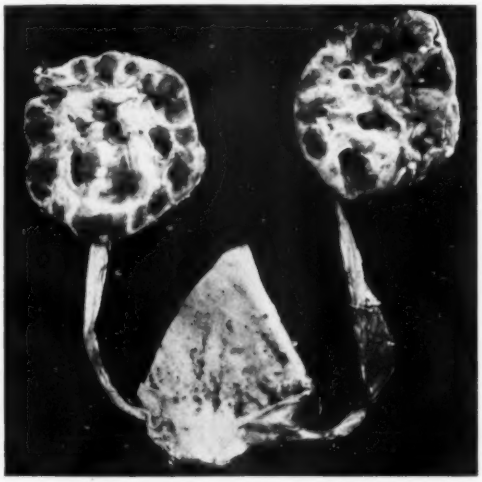

Fig. 9. Torsion of the ureters. This specimen was obtained from an infant which lived eight days. It was suddenly seized with convulsions and died four hours later. At autopsy both kidneys showed a moderate degree of hydronephrosis. The right ureter; 1½ centimeters from the kidney, became dilated to four times its normal size for a distance of 4 centimeters, at which point it appeared to be twisted on itself. After turning one-half of a revolution a probe was easily passed through to the bladder. The left ureter was also dilated, and presented evidences of torsion 2 centimeters from the bladder. A silkworm-gut suture shows the point of torsion.

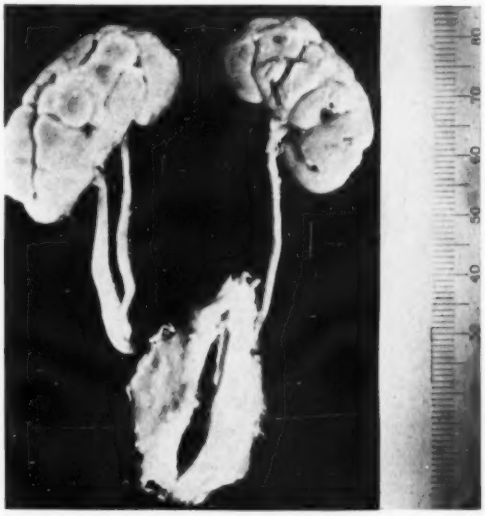

Fig. 10. Incomplete double ureter.

tory duct, or, if the anlage were formed, it was either arrested or absorbed in the early course of its development. Absence of the ureter and maldevelopment of the reproductive organs result.

Supernumerary kidneys have occurred on one or both sides. If the renal bud sprouts early, or if the division takes place at different points, each division may simulate a mass of mesochyme, in which case there would be a double secondary anlage for the kidney. These anlagen are usually placed one above the other. They either remain distinctly separate throughout the period of their growth, forming two kidneys, on one or both sides, or they fuse at some time during the course of development, forming one kidney on each side. Both sides may fuse, forming a large mass of kidney tissue.

Changes in form involving both kidneys result in what is generally known as the horseshoe kidney. It has already been mentioned that in an embryo of 7 millimeters both kidneys lie opposite the second sacral vertebra. Both may be placed at the same level, having the same relative position, or one may be ventral to the other. They may be placed one above the other, and the upper pole of one may fuse with the lower pole of the other. If they lie at the same height and at the same relative position, they may fuse at the lower poles or upper poles, or centrally. Fusion at the upper poles is much less common than fusion at the lower poles. It probably occurs before the organ has grown out of the true pelvis. The earlier the date of fusion the more definite is the line of demarcation. In cases of very late fusion, when the kidney has obtained its normal position, the union may be limited to the capsule.

In fusion at the lower pole, which is more common because they are nearer to each other than any other part of the kidney, there is always a well marked bridge of kidney parenchyma joining them. The pelvis and ureters lie ventral to the bridge. If the ureters lie behind the bridge the fusion is a later one. The pelves do not fuse because they are already well developed and independent structures before the parenchyma fuses. When central fusion takes place the organ

Fig. 11. Single kidney. (Case 1).

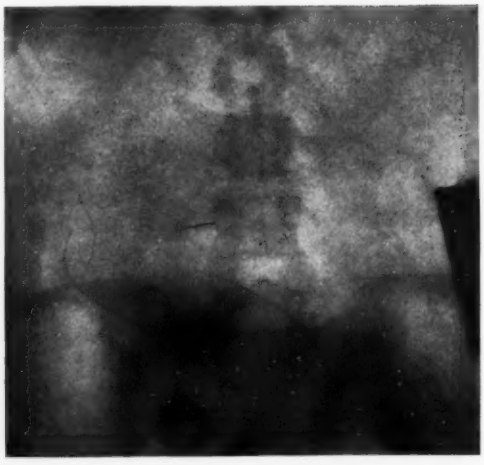

Fig. 12. Fused kidney. (Case 4).

lies in the middle line and the ureters emerge ventrally. This type is known as the disc kidney. These kidneys may have two ureters, each having a normal course and presenting a normal trigone, or there may be multiple incomplete ureters.

End-to-end fusion of the two kidneys is quite uncommon. When it occurs, both kidneys are placed on one side, generally the lower kidney is not rotated, and the ureter emerges from its anterior surface. These are late stages of fusion, as the outline of the organs can be distinguished easily one from the other. This type is known as the sigmoid kidney.

Fœtal lobulations are sometimes observed in the adult kidney. This form is due to the fact that the growth of the cortex during postfœtal life did not take place vigorously enough to obliterate the depression in the surface, and also that the cortical columns were of such depth that the usual postfœtal growth was insufficient to fill the grooves.

One of the most common forms of abnormal position of the kidney is that known as ectopic or pelvic kidney. These kidneys may be found in the pelvis or at the brim of the pelvis. The fact is that they have failed to migrate during the early embryological period of the first eight weeks, or their migration has been terminated at some time during the ascent. Many of these kidneys likewise do not rotate and their pelves remain anterior. Fused kidneys remain arrested either just above the sacral promontory, or in front of the lower lumbar vertebræ. A congenitally pelvic kidney can be differentiated from the acquired one by the length of the ureter and the relation of the vessels. Stephan (5) suggested that the causative factor of ectopic kidney was probably mechanical deviation from the normal development, such as fœtal scoliosis.

THE PELVIS OF THE KIDNEY: ITS FORM AND POSITION

Insufficient rotation or a failure to rotate leaves the renal pelvis in a mesial or anterior position. As a rule, however, the pelvis enters the hilum in the middle third of the kidney or just below it. In the case of a very long kidney the pelvis may run along the entire length of the organ. The pelvis may enter the kidney very near the lower pole. There is usually a single pelvis at the upper end of the urinary tract at the posterior site of the hilum, and it may be intrarenal or

Fig. 13. Double ureter and complete duplication of renal pelvis on right side. Sharp angulation of left ureter and incomplete duplication of renal pelvis. (Case 6).

Fig. 14. Incomplete duplication of left renal pelvis (Case 7).

extrarenal. The ureter may divide into two or more branches before entering the hilum. The branching may be due to the same causes as a double ureter, that is, a double evagination of the excretory duct, or a deep ingrowth of one of the several transverse cortical columns during fœtal development, by means of which process the pelvic division becomes dislodged downward and appears at the hilum. This wedge of kidney tissue divides the ureteral branches into two main bundles, and the pelvis into two main branches. If there are two or more of these wedges the ureteral branches may be divided into three or more portions. According to Kelly and Burnam a divided pelvis occurs in about 28 per cent of cases examined.

CHANGE IN THE URETER

Change in the form of the ureter may be coexistent with change in the form of the kidney, or it may be found with normal kidneys. Abnormalities of the ureters are dependent on the renal bud, while anomalies of the kidneys result from abnormal development of the mesochyme. According to Pohlman (63), the abnormalities of the ureters may be divided into two classes: the incomplete double ureter, and the complete double ureter. In the former, the ureter has a common opening in the bladder, and in the latter, each ureter has its own separate opening. Incomplete double ureter may be due to evagination of the excretory duct. If the renal bud divides too early, or if the division extends into the ureter segment, the splitting formed in the ureter itself would remain a permanent one, and any variation might exist from exaggeration of the upper and lower pelvis to an incomplete reduplication. In this type of ureter the pelves are always distinct. The ventral ureter arises from the upper pelvis and there is one orifice normally placed.

If the splitting of the renal bud is so complete that it is affected by the shortening of the segment of the wolffian duct, lying between it and the cloaca, it is possible for each division to acquire a distinct orifice in the duct, resulting in a double ureter. In complete double ureter the ureter from the upper pelvis has the lower orifice in the bladder, lying somewhere between the higher opening of the dorsal ureter and the opening in the genital duct.

Fig. 15. Incomplete duplication of right renal pelvis (Case 8).

Fig. 16. Incomplete duplication of right renal pelves. (Case 9).

CONGENITAL HYDRONEPHROSIS

When congenital hydronephrosis is bilateral an imperforate urethra is the most common cause. In unilateral hydronephrosis, stricture of the ureter at its juncture with the pelvis is the most common cause. Complete absence of the ureter and valves of the mucous membrane near the pelvis has also been observed in these cases. The high insertion of the ureter into the pelvis of the kidney, or its oblique insertion, have been thought by some to be sufficient reason for obstruction. Anything producing intra-uterine pressure on the ureter or bladder, thus preventing the discharge of urine into the sac of the amnion, may be considered a cause of obstruction. Supernumerary vessels in close relation to the ureter at its origin have been observed in this condition.

From the foregoing it can be seen how easily an arrest in the development of the complicated urinary apparatus may result in anomalies of number, size, form and position of kidneys or ureters, or both. Such a brief review of the embryology, with the exhibition of the specimens taken from the newborn, should lead one continually to bear in mind these possibilities, and to investigate thoroughly all cases showing the slightest variation from the normal.

We are not yet in a position to say how often anomalies are found. The following twenty-three cases from a series of some ten thousand urological examinations made by one of the writers (Bugbee), during the last ten years, probably represent but a small proportion of the anomalies present in this series. An inspection of the bladder will demonstrate only the number of ureteral orifices present, unless one or more be hidden by pathological lesions. Shadow catheters in the ureters may demonstrate anomalies in number and position of the ureters, but a pyelo-ureterogram will be necessary to demonstrate a renal or pelvic anomaly, and often a ureteral anomaly. Such examinations have been a common practice for only a few years.

Just how far we are justified in going in making kidney and ureteral injections has always been a question. Only by making a routine pyelogram on all urological cases could we begin to ascertain the frequency of anomalies of the upper urinary tract. And

Fig. 17. Incomplete duplication of both renal pelvis. (Case 10).

then, again, how often are anomalies present without giving rise to symptoms?

Of practical importance is the fact that such anomalies do exist, and that organs the seat of such anomalies are apparently prone to pathological lesions. In studying lesions of the kidney and ureter, the complete knowledge of the presence and extent of an anomaly is of great importance, not only in outlining and carrying out treatment for its relief, but also as a guide to any surgical interference and operative procedure upon the kidney.

The following rule seems justifiable: If, after a careful cystoscopic examination, ureteral catheterization, study of the separate urines and functional value of each kidney together with a roentgenogram with shadow catheters in position, there exists in the mind of the experienced urologist a question as to the exact lesion present, a pyelogram, single or bilateral, should be made. Many anomalies will never be diagnosed, but when the anomaly is associated with a pathological lesion it will probably be detected.

The following cases are briefly tabulated.

Fig. 18. Incomplete duplication of right renal pelvis. (Case 11).

ANOMALIES OF NUMBER OF KIDNEY

CASE 1. *Single kidney.* A woman, Italian, aged 20, married, was seen in consultation December 15, 1915. The patient complained of pain of a gnawing character, in the right lower quadrant of the abdomen. The pain had begun in September, 1915, and was relieved by a supporting corset. She had been free from pain until December, when it returned, became worse, and was accompanied by chills and fever, diminution of urinary output, and obstinate constipation. A tender mass was palpable in the right upper abdomen. Cystoscopic examination revealed a well-marked cystitis. The right ureteral orifice was slightly dilated, and the area about it was somewhat more congested than the remainder of the bladder wall. A catheter passed 30 centimeters. The flow of urine was rapid, cloudy, contained pus, blood cells, and colon bacilli. The function was but slightly diminished. No left ureteral orifice was found, although the trigone was easily distinguished. The right ureter was completely plugged with a large Garceau catheter, and yet no urine entered the bladder during a period of three quarters of an hour. A pyelogram showed a large right kidney pelvis with dilated calyces. There was no kidney shadow on the left side. The catheter was retained in the right kidney pelvis for three days, with daily lavage. The urine cleared, the kidney decreased in size, and the symptoms disappeared. The cystoscopic examination was twice repeated, and the findings as regards the absence of a left kidney were the same. Indigocarmine was discharged from the right ureteral orifice in normal time, but none was discharged from any other point in the bladder wall. No mass could be palpated in the kidney region on the left side.

CASE 2. *Single kidney; calculus; obstruction of ureter.* A woman, Jewish, aged 33, married, was seen August 22, 1917. She gave the history that one sister, born with one arm, died shortly after

Fig. 19. Both kidneys on the same side. (Case 12).

birth. The patient had passed a calculus eight years and another four years before this examination. Ten days previously she had hæmaturia, which was followed, seven days later, by right renal colic, and for forty-eight hours she had passed no urine. A cystoscopic examination by my associate, F. E. Du Bois, showed no urine in the bladder. A catheter passed 25 centimeters along the right ureter. There was no flow from the catheter. No left ureteral crifice could be found. A roentgenogram with the catheter in the right ureter showed the catheter obstructed at 25 cemtimeters from the bladder. Although there was no shadow in the roentgenogram, a diagnosis was made of calculus obstruction of a single ureter at the ureteropelvic junction. The diagnosis was verified at operation.

At subsequent examinations, with the right ureter completely plugged with a Garceau catheter for three-quarters of an hour, during which time several ounces of urine were collected from the right kidney, no urine entered the bladder.

CASE 3. *Horseshoe kidney; tuberculosis.* The patient, a male. Italian, aged 26, was seen in 1914. He gave the following history: Although he had never been robust, he had suffered from no serious illness until two years previous to this time, when he began to have severe urinary symptoms. Frequent, burning, painful urination, at first intermittent, had been continuous, for the preceding six months, until he was voiding cloudy, bloody urine every half hour day and night. Pain low down in the left lumbar region and to the left of the umbilicus, had developed and he was tender over the left side of the abdomen. No mass was felt. A cystoscopic examination, accomplished with some difficulty owing to the extremely sensitive bladder, revealed a normal right ureteral orifice, a dilated, rigid left orifice, surrounded by an area of œdema, congestion, and ulceration. A catheter passed 28 centimeters on the right side, and with much manipulation, 26 centimeters on the left side. The urine from the right catheter was negative, that from the left was cloudy with blood and pus, contained tubercle bacilli, and showed deficient function. A roentgenogram showed each catheter passing up close to the vertebral column and not over 4 centimeters from the median line of the abdomen at the upper extremities. A diagnosis of tuberculosis of the left kidney was made. At operation through a lumbar incision a mass was found which was supposed to be a left kidney. It was found to be part of a single horseshoe kidney, the left half of which, drained by the left ureter, was tuberculous. This portion of the kidney was removed. The patient left the hospital, but has been lost sight of.

CASE 4. *Fused kidney.* A woman, Italian, aged 26, married, was seen in consultation February 7, 1914. She complained of dragging pain low down on the right side of the abdomen. A mass could be felt lying on the pelvic brim both *per vaginam* and abdominally. Cystoscopic examination showed a normal bladder. The right catheter passed 24 centimeters, the left 26 centimeters. Clear urine was obtained from each. The roentgenogram showed both catheters passing to the right side of the abdomen and arrested above the pelvic brim in the relative position of the palpable mass. At operation a fused kidney was reported, lying above the pelvic brim. This kidney was supplied with two ureters, two sets of vessels, and there was a well marked groove between the two halves, which were separated, and an attempt was made to replace the left kidney in its relatively normal position.

CASE 5. *Fused kidney.* A woman, aged 32, Italian, married, was seen in consultation in 1913. She had had four children by normal delivery. Her chief complaint was the protrusion of a mass in the vagina for the past two years. She had a bearing-down pain on both sides of the lower abdomen, worse on exertion, and she had chronic constipation. Vaginal examination showed the uterus pushed to the right side of the pelvis by a smooth, elongated, slightly tender mass on the left side. Cystoscopic examination revealed two ureteral orifices, in normal positions. The right catheter passed 24, the left 22 centimeters. Roentgenogram showed that both catheters passed to the left side of the pelvis and were arrested, the right above the left, in the relative position of the pelvic mass. The urine from each catheter was negative. At operation the presence of fused kidney was

reported. This kidney, as in the last case, presented two ureters and two sets of vessels. The kidney was divided and each half placed as high in the abdomen as possible. A subsequent reontgenogram, in 1913, with catheters in position, showed each kidney well above the pelvis on each side, the bladder normal, and urine from each kidney negative.

ANOMALIES OF KIDNEY PELVIS

CASE 6. *Duplication of kidney pelvis (bilateral).* The patient, a man, American, aged 60, was seen February 10, 1916. Following an attack of grippe seven weeks before, he noticed blood in the urine, developed frequency and burning urination, which symptoms persisted. On examination, a large, irregular, tender mass was palpable in the right side of the abdomen. This mass could also be palpated in the lumbar region. Cystoscopic examination revealed a slight congestion of the entire vesical mucous membrane. A catheter entered each of the ureteral orifices, which were in normal position, and passed 25 centimeters on the right side and 28 centimeters on the left side. The urine from each side was hazy with pus and both showed colon bacilli on culture. The function on the right side was two-thirds that of the left. The phthalein output from both kidneys was 51 per cent for two hours. A double pyelo-ureterogram was made, which showed on the right side double ureter above the pelvic brim and a complete duplication of the renal pelvis, each pelvis having three calyces, the lower calyx of the upper kidney joining the upper calyx of the lower kidney. On the left side there was a sharp angulation of a single ureter at the uretreopelvic junction, and an incomplete duplicate of the pelvis of the kidney. This patient was relieved of his acute symptoms under colonic and pelvic lavage.

CASE 7. *Duplication of left renal pelvis.* The patient, a man aged 34, was seen April 20, 1918. One month before he had been seized with severe pain in the left lumbar region, radiating to the groin. This was relieved by passing a long, thin blood clot. Since then hæmaturia had persisted, with moderate vesical irritability. Cystoscopic examination showed a slightly congested trigone—that the blood was coming from the left ureter. Catheterized specimens showed a negative urine on the right side, the left contained much blood, pus cells, and colon bacilli with deficient function. A pyelogram revealed a double kidney pelvis on this side.

CASE 8. *Incomplete duplication of right renal pelvis.* The patient, a woman, aged 46, married, American, was examined by my associate, F. E. Du Bois, on March 7, 1918. Her history was that nine months ago she began to have frequency at night and voided every two hours by day. This condition has persisted. She then voided every two hours night and day, with burning. Both kidneys were palpable, but were not tender. Cystoscopic examination revealed a congestion of the trigone and vesical neck. The ureteral orifices were normal and a catheter passed 34 centimeters on each side. There was a rapid flow of urine from each kidney which, on examination, showed pus cells, colon bacilli, and an equal function. Roentgenograms with X-ray catheters in position showed a prolapse of the right kidney, with the patient in the erect posture, and a pyelogram revealed duplication of the renal pelvis.

Fig. 20. Right kidney low and not rotated. (Case 13).

CASE 9. *Incomplete duplication of right renal pelvis.* A woman, aged 52, American, widowed, was seen in consultation, June 7, 1917. She complained of pain in the right upper quadrant, and frequent burning urination of six months' duration. Gastric distress, constipation, and jaundice had been noted for the previous three weeks. There was tenderness and rigidity of the right rectus. The urine was highly colored. The bladder showed hyperæmia of the trigone; the ureteral orifices were normal; catheters passed 30 centimeters on each side. The urine from the right kidney was cloudy, contained blood cells, pus and colon bacilli, while the left kidney excretion was negative. The function of the right kidney was diminished one-third. A pyelogram revealed an incomplete duplication of the right kidney pelvis. An exploration of the right upper quadrant of the abdomen was made. The report gave acute cholecystitis with obstruction of the cystic duct as the primary lesion giving rise to the abdominal symptoms.

CASE 10. *Incomplete duplication of both kidney pelves.* The patient, a woman, aged 24, American, married, was first observed in 1916. She complained of pain in the left side of the abdomen and back.

Fig. 21. Obstruction of left ureter. (Case 15).

Fig. 22. Ureteral bougie passed through obstruction in contact with calculus in pelvis of pelvic kidney. (Case 15).

She had had nine attacks, each coming on with severe pain in the lumbar region, nausea, vomiting, chills, and fever, accompanied by frequency, urgency, and hæmaturia, and followed by soreness in the flank. The last attack was five weeks before coming under observation. A large tender mass could be felt in the left kidney region and a small, smooth, non-tender mass in the right side of the abdomen, low down. The latter mass was not movable. Cystoscopic examination showed slight congestion of the vesical mucosa, more apparent about the left ureteral orifice. A catheter passed 26 centimeters along the right ureter. There was no obstruction of the ureter, and there was a normal flow of amber-clear urine from this side. The catheter on the left side passed 32 centimeters. The flow was rapid and the urine colorless and cloudy with pus. Analysis showed a colon bacillus infection on the left side, with diminution of function, a normal kidney output on the right side. A double pyelogram showed a moderately low-placed kidney on the right side, with no ptosis or ureteral kink, a high-placed kidney on the left side. Both kidney pelves showed an incomplete duplication. This patient was relieved by pelvic lavage.

CASE 11. The patient, a woman, aged 46, complained of pain in the right upper quadrant. The pain was dull in character had persisted for seven weeks and was accompanied by frequent burning urination. The right kidney could be palpated, was slightly enlarged and tender. Cystoscopic examination revealed a moderate congestion of the urethra and trigone. Catheters passed to either kidney 31 centimeters. The left urine was negative. The right showed pus and colon bacilli. A pyelogram revealed an incomplete duplication of the right renal pelvis.

ANOMALY OF POSITION OF KIDNEY

CASE 12. *Both kidneys on same side.* The patient, a woman, Italian, aged 16, single, had an appendectomy four months before coming under observation, June 26, 1910, for pain in the right lower quadrant. This pain was not relieved by the operation, and was aggravated when the patient was on her feet. A small, regular mass could be palpated in the right lower quadrant, and the lower pole of the right kidney could be palpated above it. Cystoscopic examination revealed a normal bladder and normal ureteral orifices. The catheter in the right ureter passed 30 centimeters, that in the left, 26 centimeters. The flow from the right catheter was twice the amount of that from the left, and the functional capacity was in the same porportion. Culture showed staphylococcus aureus from the left side, negative culture from the right. A double pyelogram showed both kidneys placed on the right side of the abdomen, the right above the left, the latter being an organ of infantile type. This patient was greatly relieved by pelvic lavage.

CASE 13. *Right kidney low and not rotated.* The patient, a woman, American, aged 19, married, came under observation in January, 1914, complain-

Fig. 23. Tuberculosis of single functionating kidney. (Case 18).

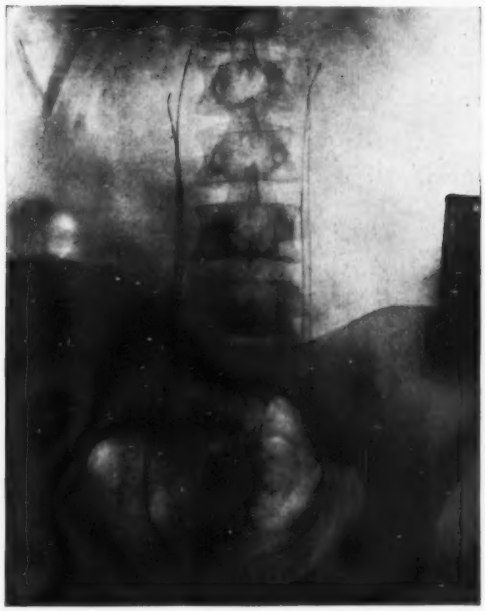

Fig. 24. Bilateral duplication of ureters. (Case 19).

ing of epigastric pain, nausea, vomiting, frequent burning urination, extending over a period of three months. A globular mass which was of the size and shape of a kidney, could be felt on the right side of the abdomen at the level of the umbilicus. Cystoscopic examination revealed a congested bladder, normal ureteral orifices. A catheter passed 25 centimeters along the right ureter, 31 centimeters on the left side. The urine from each side contained pus cells and colon bacilli on culture. The renal function was normal. A double pyelogram showed that the right kidney had not rotated, the renal calyces pointing toward the vertebral column, nor had it ascended to its normal position in the lumbar region. There was no kinking of the ureter, and the left ureter and kidney were in normal position. A laparotomy revealed an undescended cæcum and a diseased appendix. The appendix was removed.

CASE 14. *Migration of kidneys to opposite sides in their ascent; crossed ureters.* This patient, a woman, aged 33, married, came under observation October 13, 1914. She complained of frequent, painful urination, which had persisted and become progressively worse over a period of ten years. This was accompanied by loss of flesh and strength. Physical examination was negative. Cystoscopic examination was exceedingly painful, owing to a contracted and highly sensitive bladder, which retained but two ounces of fluid. The examination revealed well-marked œdema, congestion, and ulceration of the right side of the trigone and bladder wall, particularly in the immediate neighborhood of the dilated, rigid right ureteral orifice. The left ureteral orifice appeared normal and there was but slight congestion immediately about it. A catheter entered either orifice, but was obstructed 1.5 centimeters from the bladder on the right side, and at 2 centimeters from the bladder on the left side. No specimen could be obtained. Indigocarmine returned in good amount from the left ureteral orifice in five minutes. None was emitted from the right ureteral orifice in 25 minutes. The bladder urine showed large quantities of pus and numerous tubercle bacilli. A diagnosis of tuberculosis of the right kidney was made, and as at subsequent cystoscopic examinations it was found impossible to pass the ureteral catheter beyond the points above noted, the right kidney was removed without splitting it. This kidney, after removal, showed a pyelonephritis only, but no tuberculous lesions. The patient died of uræmia seven days after operation, and at autopsy it was found that the ureter leaving the left lateral angle of the trigone passed back of the bladder, crossed the right ureter, and ascended in the right side of the abdomen to the right kidney, while the ureter from the right side of the bladder passed in a like manner to the left kidney. Thus the urine from the right kidney was emitted from the left ureteral orifice in the bladder, and that from the left kidney from the right ureteral orifice. The left kidney was almost entirely destroyed with tuberculosis, the ureter the seat of strictures, the lowest being one-half centimeter from its point of entering the bladder wall. The right kidney, which had been removed, was com-

parativley normal, and the ureter was normal with the exception of a complete torsion, just before entering the left side of the bladder wall.

CASE 15. *Pelvic kidney with calculus.* The patient, a male, aged 27, Jewish, single, was first seen October 10, 1917. He complained of pain in the left lower abdomen, hæmaturia, and frequency of urination. Seven years before he had noticed that his urine was dark, but that it cleared after a few days' rest in bed. One year before coming under observation he had a sharp attack of pain in the left lower abdomen, accompanied by nausea and followed by hæmaturia. During the year he had many such attacks. His physical examination revealed a bad condition of the teeth and a tender mass slightly to the left of the abdomen and below the umbilicus, extending down into the pelvis. Cystoscopic examination showed a bladder mucosa somewhat congested but otherwise normal. A catheter passed 30 centimeters to the right kidney, and there was a normal flow of hazy urine which contained pus cells and colon bacilli. The catheter on the left side passed 17 centimeters and was obstructed, although a specimen of urine was collected which showed a sediment of pus, many colon bacilli, and a markedly deficient renal function. An injection was made through the catheter and a roentgenogram taken showed the solution had not passed the point of obstruction. The catheter was removed and a soft ureteral bougie inserted. This passed the obstruction after some manipulation, and the roentgenogram showed it to have entered the pelvis of a pelvic kidney and to be in contact with a calculus lying in the pelvis of this kidney. The kidney rested on the promontory of the sacrum.

CASE 16. *Pelvic kidney; pregnancy.* A woman, Russian, aged 24, was seen in consultation in 1916. The patient was pregnant for the first time, then in her sixth month. She had complained of pain in the lower back and pelvic region since the third month of pregnancy. This pain had become progressively worse. For four days she had suffered from frequent, painful urination, from vomiting and steady bearing down pain in the pelvic region.

On vaginal examination a smooth, slightly tender mass could be palpated posterior to the uterus, in the median line, resting on the promontory of the sacrum. The mass had the general contour of a kidney. Cystoscopic examination showed marked pressure in the bladder from the enlarged uterus, and an acute cystitis. The mucous membrane about the left ureteral orifice was slightly œdematous. A catheter passed to the right kidney 30 centimeters with little difficulty. On the left side the catheter passed 21 centimeters. The urine from the right kidney was negative; that from the left side was cloudy from pus, contained colon bacilli, and showed deficient kidney function. A roentgenogram showed left catheter passing slightly upward from the bladder, then directly backward, and coiled up in the pelvis of a pelvic kidney, which was the mass palpated through the vaginal vault.

CASE 17. *Pelvic kidney.* A woman, aged 22 was seen three weeks after her first confinement. The labor had been a prolonged and difficult one, requiring forceps. During the latter months of pregnancy the patient had complained of frequent, painful urination and severe pelvic pain. The pain was relieved somewhat following the delivery, but the urinary symptoms persisted. The general physical examination was negative other than the presence of a mass easily palpated in the left side of the pelvis, *per vaginam*. A cystoscopic examination revealed a well-marked cystitis, with somewhat more congestion about the left than the right ureteral orifice. A catheter passed to the right kidney 31 centimeters and a normal flow of clear, negative urine was obtained. A catheter passed 23 centimeters on the left side. The urine obtained contained pus, blood cells, and colon bacilli. The function of this kidney was deficient, being one-half that of the other side. A roentgenogram with catheters in position showed a right kidney in normal position, the left situated in the pelvis.

ANOMALIES OF URETERS

CASE 18. *Obliteration of lower ureter; infantile kidney.* A woman, aged 34, American, single, was first seen November 1, 1915, complaining of frequent, painful urination of six months' standing. She voided every three hours by day and twice at night. There was a urethral stricture at the internal meatus which was dilated and five ounces of residual urine found in the bladder. Cystoscopic examination revealed a very much congested bladder mucosa with a dilated, rigid left ureteral orifice surrounded by an area of œdema, and posterior to the trigone on this side was a small ulcerated area which bled easily. No right ureteral orifice could be seen, although the trigone was well outlined. The urine from the left kidney contained pus and tubercle bacilli. Repeated examinations over a period of two years always revealed the same bladder picture. The left ureter was plugged with a Garceau catheter and four ounces of urine collected from the left kidney, while no urine entered the bladder. A pyelogram showed a tuberculous lesion in the left kidney. Exploratory laparotomy in 1917 revealed a small right kidney, with a smooth surface and no visible lesions. The pelvis and ureter were slightly dilated, the ureter was dilated, but not thickened, and ended below the pelvic brim in a fibrous cord.

CASE 19. *Bilateral duplication of ureters.* The patient, a woman, aged 32, Irish, married, was seen December 1, 1916. She complained of backache, headache, pain in the lower abdomen and pelvis, and frequent burning urination. She had had three children and had received extensive perineal lacerations. The backache had been severe for four years. For six weeks she had had pain in the right lower quadrant. The uterus was retroverted and prolapsed. Cystoscopic examination showed slight congestion of the vesical trigone and two

normal ureteral orifices in each lateral angle of the trigone. Catheters entered each orifice and passed 31 centimeters. The urine from each was negative other than the presence of a few pus cells and colon bacilli. A roentgenogram taken with catheters in each ureter revealed four ureters distinct thorughout, the anterior ureter having the higher insertion into each renal pelvis. No pyelogram was made, so we were unable to ascertain whether there was a duplication of the pelves.

CASE 20. *Duplication of ureter, one side.* A woman, aged 29, was sent for treatment in 1909. She complained of chronic constipation, frequent, painful urniation, and discomfort in the right lumbar region. The right kidney could be palpated, was slightly enlarged and tender.

A cystoscopic examination revealed a congestion of the entire bladder mucous membrane, more marked on the right side in the region of the lateral angle of the trigone. On this side there were two ureteral orifices. A catheter entered each and passed 30 centimeters. Cloudy urine, containing pus, blood, and colon bacilli, was discharged through each catheter. There was a single ureteral orifice on the left side. A catheter passed 31 centimeters to this kidney with ease, and the urine obtained was normal.

The right kidney was exposed through a lumbar incision, and proved to be slightly enlarged, prolapsed, and very much congested, but otherwise normal. There were two ureters leading from a single pelvis. The ureters were slightly dilated but not thickened.

The kidney was denuded of its capsule and sutured as high up as possible.

CASE 21. *Bilateral duplication of ureter.* A woman, single, aged 36, was seen in 1910. The chief complaint was frequent painful urination over a period of fifteen years. Physical examination was negative. Cystoscopic examination showed a urethral stricture of small calibre. This was dilated and a cystoscope introduced. The area of the trigone showed hyperæmia and in each lateral angle were two apparently normal ureteral orifices. They were about 1 centimeter apart. A catheter entered each and passed 30 centimeters. Urine from each kidney was normal. No roentgenogram was made.

CASE 22. *Bilateral duplication of ureters.* A male, aged 24, came in 1912, for an operation for hypospadias, the floor of the terminal 3½ centimeters of the penile urethra being absent. There was no venereal history, and the physical examination was negative. A cystoscopic examination revealed, in an otherwise normal bladder, two ureteral orifices on each side in relatively the same position. i. e., in the lateral angle of the trigone, about 1 centimeter apart, the second being posterior to and to the outer side of the first. The appearance of each opening was normal. The catheter was passed into each orifice and advanced 31 centimeters. The urine from each side was normal. A roentgenogram with shadow catheters in position, on one side verified the diagnosis.

CASE 23. *Bifurcation of lower ureter.* The patient, a woman, aged 36, American, single, came for observation April 2, 1918, complaining of frequent, painful urination over a period of six months, becoming more severe until she then voided every half hour day and night. She had lost weight and strength. There was slight tenderness in the left lumbar region. Cystoscopic examination revealed a contracted, inflammed bladder, the mucosa being congested throughout, more pronounced about the left side of the trigone. A ureteral orifice was observed on this side, dilated, rigid, and overhung with an area of granulations. A catheter entered the orifice, passed 2½ centimeters, when it was seen to emerge from another orifice 1½ centimeters above and to the outer side of the first orifice. There was a single normal ureteral orifice on the right side of the trigone. A catheter passed 30 centimeters to the right kidney, and normal urine was obtained. The bladder urine contained pus and tubercle bacilli. A roentgenogram showed that there was a bifurcation of the left ureter 1½ centimeters from the vesical opening.

These 23 clinical cases represent 2 single kidneys, both the seat of infection, one presenting a calculus obstruction of the single ureter; three fused kidneys; one horseshoe kidney, the seat of tuberculosis, and two fused kidneys apparently free from infection but causing pressure in their anomalous position. All six cases showing duplication of the renal pelvis had a pyelonephritis. The six cases presenting one or both kidneys in an anomalous position showed renal infection, one being tuberculous, and another having a renal calculus. The six cases showing anomalies of one or both ureters all were the seat of renal infection.

From the above it will be seen that all but two of the cases presented renal infection which indicates that a single kidney called upon to do double work, a malformed or malplaced kidney having poor drainage, poor blood supply and subject to pressure is particularly prone to infection. Anomalies of the ureter also interfere with kidney drainage, thus predisposing to infection.

The necessity for assisting such kidneys to perform their function is apparent. The indications are to throw less work upon the kidneys. With four exceptions the infections were all of the colon type. The necessity of attention to the intestinal tract is apparent. Lavage of the kidney pelvis has been bene-

ficial, and permanent drainage often for several days with the ureteral catheter has proved efficacious. The surgical indications are to improve drainage and relieve pressure, if necessary, by placing the kidneys in more nearly their normal position; to remove any obstruction to renal drainage (as a calculus) to remove a diseased kidney when destroyed beyond repair, if the opposite kidney is able to carry on the necessary function, or in rare cases to remove the kidney which cannot be replaced and is causing pressure symptoms due to its malposition. Whenever an abdominal mass is found, a renal anomaly must be excluded. If it is not possible to make a positive diagnosis of the extent of the lesion before operation, the operation should include an exploration of both kidneys.

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The author cites the case of a boy, 12 years of age, whose death was due to other causes. The following conditions were found to exist: (1) single or asymmetrical left kidney, (2) duplication of ureter, (3) union of the two branches of the left ureter 3 inches from bladder, (4) right and left ureteral orifices in bladder, (5) right ureter, patent from from bladder to its blind upper extremity; right kidney, renal artery and vein, and right suprarenal were absent.

"As far as I have been able to ascertain from a study of the literature, no other cases have been recorded of asymmetrical kidney, with partial duplication of its ureter co-existing with a patent ureter on the side on which the kidney is absent.

"The condition of single or asymmetrical kidney is by no means common, being found, according to Morris (Morris, H. Surgical Diseases of Kidney and Ureter, 1901), in only one out of 2,400 autopsies; 213 were collected from literature by Ballowitz (Virchow's Arch. of path. Anat., Berl., cxli, 390) in 1895, 286 by Anders (Anders, J. M. J. M. Sc., 1910, cxci, 313) in 1910, and 300 by Dorland (Dorland, W. A. N. Surg., Gynec. & Obst., 1911, xiii, 303) in 1911. Probably these figures are too large, some of the cases, especially those recorded by the earlier writers, being examples of fused and not of single kidney. The congenital absence of the kidney is due to failure of the wolffian duct to throw off the corresponding renal bud after the duct has reached the cloaca.

"Duplication of the ureter, which is usually incomplete, as in my case, is not so very uncommon, being found in 1 to 2 per cent of all corpses (Lessing. Charité Ann., Berl., 1906, xxx, 452). The association of solitary kidney with complete or partial duplication of the ureter, though uncommon, is not unique.

"The presence of a ureter on the side on which the kidney is absent is very exceptional. Out of 286 cases of single kidney collected by Anders (loc. cit.) there were only twenty-four in which a more or less rudimentary ureter was present on the side on which the kidney was absent. In the majority of these cases the ureter was impervious, and I have been able to find only seven cases in which, as in my own case, the ureter was patent throughout its entire length."

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"An unusual difficulty which might be met in renal surgery on the living patient is illustrated by a recent experience in attempting nephrectomy on a cadaver in the Laboratory of Anatomy of the University of Pennsylvania." The body was that of a male, 71 years.

"Explanation. The primitive kidney is a pelvic organ derived from a portion of the paravertebral mesoblastic tissue of the pelvic wall. the renal blastema, and from the branching subdivisions of the expanded ends of the primitive ureter, which contribute that portion of the uriniferous tubular

system represented by the straight collecting tubules. Each organ is formed independently, and possibly as a result of changes in the line of curvature of the caudal extremity of the spinal column, ascends until by the end of the third month of fœtal life has reached its adult position. Fusion of the renal masses, as in this case, would cause retardation in the ascent, probably as a result of the development of the sacral promontory, which would offer obstruction to the isthmus in the midline and prevent the normal passage upward of the lateral masses along the iliolumbar grooves. Nature vascularizes the renal tissue from adjacent vessels and this would contribute to the difficulty of ascent, as illustrated by the markedly angular course of those renal arteries in our specimen which are derived from the anterior surface of the aorta near its bifurcation. It is our conception that the dum-bell type illustrates fusion of the lower poles of the primitive kidneys which in ascending were rotated as it were on their backs and transversely, as a direct result of retardation in ascent of the midportion or isthmus."

"Congenital fusion of the kidneys finds its most frequent expression in the horseshoe kidney. There are various intermediate forms of fusion between this, which Rokitansky calls the lowest degree of fusion, and the highest degree of fusion, namely when the kidney is fused into a discoidal mass lying usually in the median line, misplaced downward, and often provided with a double pelvis and two ureters.

"Clinical importance. The malformed kidney as a rule gives rise to no clinical symptoms unless complicated or through pressure as the result of misplacement. Any disease to which the normal kidney is subject may affect the malformed organ, but hydronephrosis and its frequent sequel, pyonephrosis, are the most frequent complications." Pressure of the anomalous vessels on the ureter is the cause in the majority of cases, as shown by William J. Mayo (Proc. Surg. Ass., 1911).

"Important steps in the recent progress of the surgery of the horseshoe kidney are the division of anomalous blood-vessels causing ureteric obstruction, division of the isthmus to relieve pressure symptoms, ureteropelvic anastomosis, plastic operations on the renal pelvis for hydronephrosis and hemi-nephrectomy by the transperitoneal route."

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"The pathologic condition existing in the anomalous kidney or ureter usually calls our attention, clinically, to its existence, That such kidneys are peculiarly liable to disease has been noted by various observers. The frequency with which such anomalies are found in a surgical clinic as compared with postmortem records of a general hospital would, therefore, be at least partially explained by the fact that the complicating conditions usually require surgical treatment."

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TUBAL AND OVARIAN HÆMORRHAGE

Its Etiological Relation to Pelvic Hæmatocele and Extra-Uterine Pregnancy[1]

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IN considering ovarian and tubal hæmorrhages, I am excluding those forms arising from tubal pregnancy and from overwhelming trauma or hæmophilia. Many case reports were of virgins and one in a women past the menopause.

FREQUENCY

Without careful study of ovarian and non-pregnant tubal hæmorrhage, one might think its occurrence was so rare as to be a novel or grotesque condition. But careful analysis of abdominal surgical work, including microscopical study will demonstrate that it is not a rare condition. As an instance, I may here recite briefly the history of a patient seen one night last month with Dr. A. L. Stavely.

A spinster of 32 years usually tardy in menstruation, that habitually lasted seven days, and had ceased menstruation the day before, fell in the street at midday from sudden and severe pain in the hypogastrium while on a shopping trip. She was removed to the office of an osteopathist who had been treating her for constipation and vague abdominal pains. She required the patient to drink large quantities of salt water which failed to cause vomiting. In the evening there was general abdominal rigidity though I was told two doses of morphia had been taken during the preceding two hours. The temperature was slightly above 100° F., and pain was not a special feature. She chatted with me while I made a vagino-abdominal examination that revealed retroversion of the uterus with some enlargement and fixation of the appendages. Dr. Stavely and I could not differentiate between ovarian hæmorrhage, appendicitis, and intestinal perforation, but the condition being evidently some grave lesion in the abdomen, she was at once opened by Dr. Stavely and a large amount of free blood that had escaped from a small ruptured ovarian cyst, the diameter of which he estimated as three inches, was found. No other reason for the attack was found.

Other cases might be cited to show the frequency of the condition and particularly that it is often a grave one. Novak reported a collection of 40 cases and Jayle 17, three of which were his.

CAUSES

Trauma plays a part in producing these hæmorrhages as instanced in the cases reported by Freeman, Primrose, and many others. The ingestion of poisons of various kinds are reported as exciting causes. The ingestion of oxytoxics and emmenagogues to interrupt a supposed pregnancy, especially when it did not exist, has been the cause in many cases. No doubt toxic conditions predispose to these hæmorrhages. Inflammatory changes and other pathologic conditions, including neoplasms, are causative agents. Possibly, instability of ovarian tissue and maladjustment of the internal secretions at puberty are provocative.

Hæmorrhage from the fallopian tube may occur from general conditions that similarly effect other tissues and need not be considered here. Venous stasis from circulatory disturbances or pressure from tumors may be reasonably included in a list of its causes. Vicarious menstruation may occur in the tube as well as from mucous membranes in different parts of the body. While I have not found case reports in the literature, I believe it can occur in infancy as well as can hæmorrhage from the ovary, as described by Tate, B. Schultze, and others, or from the uterus, a condition often reported by careful observers. Tubal neoplasms, especially carcinoma, may give rise to severe hæmorrhage. Local infections probably constitute a frequent cause of tubal hæmorrhage. Exposure to cold, particularly during or immediately before menstruation has been regarded by several reporters as the cause of ovarian hæmorrhage. Doran reports the case of a woman critically ill from a supposed ruptured tubal pregnancy in which he found a large hæmatocele formed from blood escaping from the fimbriated end of a tube that was neither ruptured, pregnant, enlarged or inflamed. No cause for the hæmorrhage was given. Beyond doubt tubal pregnancy is the cause in a preponderating pro-

[1] Read before the American Gynecological Society, Philadelphia, May 15, 1918.

portion of tubal hæmorrhages. Inflammatory infiltrations which compress and obstruct venous return from the tubes is thought to be the next most frequent cause.

Ovarian hæmorrhage may be confined within the ovary, constituting one or more hæmatomata or it may take place into the peritoneal cavity, producing, if abundant, an hæmatocele. In the former variety it may occur in the stroma, into new-growths or into follicles in any state of development. Several such hæmatomata may coalesce. Both may occur coincidentally and in fact, it is thought follicular may lead to stromal and *vice versa*. Between 1850 and 1859 Nélaton, Rokitansky and Puech had published their monographs on severe follicular hæmorrhage. If before or during follicular hæmorrhage rupture of the follicle or of the wall about a stromal active hæmorrhage occurs, the peritoneum may be deluged. Slight hæmorrhage from the follicle is regarded as a normal incident of ovulation. But the loss of more than a slight amount of blood in this manner must be regarded as pathologic. Ovarian hæmorrhage nearly always occurs during menstrual life. Probably its occurrence in the postclimacteric period of life is very rare. R. H. Harte reports the case of a woman long past the menopause who, while riding in a carriage, was seized with a severe attack of abdominal pain in the region of the appendix vermiformis. She had a history of chronic appendicitis and the inference was that that disease was the cause of the pain. Not improving in bed the abdomen was opened to find the abdomen filled with blood and an ovary ruptured across with free hæmorrhage from it going on. The ovary was found to contain an angiosarcoma. Several cases at birth have been reported and many striking ones chronologically near, or during, the first menstrual period though these two epochs in life cannot be regarded as having notable predilection for ovarian hæmorrhage. Probably conditions of the ovary at the time of menstruation afford the most potent factor in predisposition. Certainly a very large proportion of the reported cases have occurred during or within three days of menstruation. Bloodgood's 2 cases occurred the day before menstruation was expected. This synchronization between menstruation and ovarian hæmorrhage has been well fixed in our minds since Scanzoni reported his celebrated case in which at autopsy on the body of a young girl who had died during menstruation, he found three liters of blood in the peritoneal cavity, clearly from a ruptured ovarian follicle. Many like reports are recorded in the literature of the Surgeon General's Library. Ovarian pregnancy was the cause in one of the 35 cases of death from ruptured ectopic pregnancy reported by Formad. But as less than 25 authentic cases of this form of pregnancy have been reported, its share in etiology must be regarded as small—quite in contrast with tubal gestation in this relation.

The form of ovarian hæmorrhage, by far the most frequent and most interesting, will be discussed more fully in taking up the pathology of these hæmorrhages.

PATHOLOGY

No other organ of the body is so frequently the seat of hæmorrhage as is the ovary and a large amount of literature has been written on the pathology of the ovary in ovarian hæmorrhage. Much of it is repetition. I shall not discuss the pathology of hæmorrhage into the wall or the interior of ovarian cysts, at or subsequent to twisting of the pedicle, which is far from infrequent, nor will I take up ovarian pregnancy.

Stromal hæmorrhage is commonly preceded by infection of the ovary. Chronic ovaritis results in the development of additional connective tissue which frequently prevents rupture of the graffian follicle and retains it as a cyst. A sclerocystic condition is produced and fatty degeneration of the blood-vessel walls of the stroma follows. In the prolonged ovarian congestion incident to ovulation, or attempted ovulation, those vessel walls rupture, allowing the escape of blood either into the stroma or into the cysts retained; in one or several areas. This may also occur without ovaritis as is well shown in the case reported by Whitehouse, which occurred in a single woman of 40 years and whose menstrual periods since puberty at

16 years had each time been distressingly painful in spite of dilatation of the cervix uteri and curettage. The removed ovaries each contained on section multiple petechial or punctiform hæmatomata, most numerous in the subcortical layer, with no extensive extravasation at any place. Corpora lutea of different stages of retrogression were present. The blood cells were found free in spaces and confined within vessels. Frequently a recent hæmorrhage was found abutting against one of longer duration, the contrast being very evident. There was no evidence of excess in fibrous tissue or of inflammation. Several writers speak slightingly of the pathological and clinical significance of stromal hæmorrhage. But the pathologist and surgeon of gynecology lacks such disregard for the gravity of this form of ovarian hæmorrhage. Generally speaking it must be regarded as a product of sclerocystic degeneration—chronic ovaritis, a condition decidedly prejudicial to the integrity of the organ. Yet one cannot discredit the follicular form as a cause of the stromal variety. Moreover, infection is most apt to be a complication of stromal hæmorrhage. Several authors have written quite lengthily of the pathology of ovarian hæmatoma, including corpus luteum cysts and I shall pass over that subject, making only a few suggestive statements. The theca interna of the maturing follicle contains a richly supplied plexus of small blood-vessels which penetrate to the tunica granulosa. Following the rupture of the follicle, in the earliest stages of the corpus luteum, a much richer blood supply is developed and is termed by writers as the stage, or period, of hyperæmia. These blood-vessels are specially well developed next to the tunica granulosa and become smaller there when the lutein layer is completed. But the thecal vessels remain prominent until retrogression of the corpus luteum is nearly completed. In a large proportion of follicles, death of the ovum occurs in an early stage of development and a gradual degeneration of the tunica granulosa takes place. As a result of this death at various stages of development of the follicle a great variety of follicular cysts is found, with walls varying from a single layer of cuboidal epithelium to several layers. The cavities are found in various stages of atresia resulting from absorption of surrounding cell layers, fibrous tissue taking their place and producing the corpus fibrosum, to be distinguished from the corpus albicans—the terminal structure of the corpus luteum. These transitions were well shown in the case of Whitehouse. Some writers state the follicular form of hæmorrhage is much rarer than supposed and that the atretic follicle is by far the most frequent site of ovarian hæmorrhage. I believe this statement is true, but practically we should attach but little importance to it as, clinically, the time of predilection of such hæmorrhage into atretic follicles when of severe type, is during or very near menstruation—the usual time of severe hæmorrhage from follicles. Moreover, the atretic follicular form is usually not attended by such grave symptoms as appear with hæmorrhage into the follicle, or corpus luteum. Exceptions are those rare cases in which rupture of the ovary with hæmorrhage occurs, somewhat as in the case of the ruptured tube. The large follicle, nearly or completely developed, is far more easily ruptured, with alarming symptoms, than is the atretic follicle, though the much greater number of the latter might make the incidence of the site of hæmorrhage in favor of it. Hæmorrhage from the corpus luteum with resulting intraperitoneal hæmatocele seems so simple and easy that one wonders at its infrequent recognition. Like early tubal gestation, it may occur in a small degree without notable clinical evidence and probably often is unrecognized before operation or autopsy in but a marvelously small percentage of cases. Under such conditions to doubt that slight ovarian hæmorrhages may occur without even suspicion is illogical.

The large number of cysts often seen in the ovary is not wholly indicative of a sclerocystic condition, i. e., the ovary that is undergoing chronic inflammatory changes, and commonly has constricted zones outlined on the surface by girdling grooves underlaid by fibrous tissue, though earlier, before contractions have taken place, the surface resemblance to the cystic ovary is strikingly great. The so-called "cystic degeneration" is produced

by overstimulation in the process of maturation of follicles which have aborted and become atretic follicular cysts. It may be well to mention in passing, that "cystic ovaries" are indicative of ovarian hyperstimulation and overactivity rather than of hypofunction and disease and *cæteris paribus*, to be preserved rather than ablated. The sclerocystic ovary does not or should not enjoy such favorable consideration. No doubt hæmorrhage into these cysts is very common and equally probable is it that it results in unimportant phenomena. However, this result is not always so innocent. As these atretic cysts are so remarkably thinly lined before they become corpora fibrosa and are surrounded by such a great development of young blood-vessels, hæmorrhage into them might be expected to occur commonly. Probably the high degree of intracystic pressure, really greatest at this juncture, from general ovarian hyperæmia, and which to a greater or lesser degree neutralizes intravascular pressure accounts for it. It often occurs that such hæmorrhages into multiple cysts cause multiple hæmatomata which coalesce to form large hæmatomata. Either the small or the large ones may rupture into the peritoneum with more or less severe resulting hæmorrhage, when once the intracystic tension is removed. The naked eye appearance of such conditions does not enable one to distinguish the cystic from the sclerocystic ovary, unless the presence of pre-existing ovarian adhesions, or girdling, constricting bands of fibrous tissue are present. The microscopical evidence, however, should be ample for differentiation. Ofttimes the intracystic pressure is sufficient to prevent invasion by blood that escapes from the perifollicular zone of new blood-vessels, small infarcts, more or less zonal in shape, forming outside the cyst lining and easily becoming stromal hæmatomata.

In the corpus luteum the granulosal, zonal plexus of blood-vessels is probably more extensively developed than in the atretic form of follicle and in addition vascularization inside the follicle takes place; the two processes overlapping chronologically, in fact. The vascular area forms a lutein layer that is in turn abundantly supplied by capillaries from the perigranulosal area. At this time a moderate amount of blood escapes into the cavity of the corpus luteum and becomes adherent just within the layer of the lutein tissue. Early in the development of the corpus luteum, in fact until the corpus luteum is well matured, hæmorrhage may occur from the vascularized area into the luteal cavity and perhaps the blood be poured into the peritoneal cavity. Hæmorrhage into the luteal cavity may be so great as to interfere markedly with the process of maturation. Later, however, this type of hæmorrhage is less liable to occur as the blood-vessel walls become more resistant as do the walls of the corpus luteum.

SYMPTOMS

Non-gestational tubal hæmorrhage probably has no diagnostic symptom or symptom-complex. The symptoms of ovarian hæmorrhage are by no means distinctive. They vary from none known in cases in infancy found at autopsy to those at puberty resembling very closely dysmenorrhœa of ovarian or cervical origin and even to those severe attacks that have caused death or led to emergency abdominal sections,. Usually a history of sudden exertion that indirectly influenced the pelvic region has been followed by a very severe degree of pelvic pain, paroxysmal or quite continuous. Sometimes the pain is referred to the umbilicus or epigastrium, gradually limiting itself to the affected iliac fossa or lower abdominal zone, vomiting and collapse soon following. In some cases the pain has been well distributed throughout the abdomen and pelvis. General tenderness and muscular rigidity of the whole abdomen is usually present. Vagino-abdominal examination reveals great tenderness about the appendages. Wilson says the shock where there is no actual peritoneal hæmorrhage is out of all proportion to the extent of the lesion found. He states the two cardinal symptoms are abdominal pain and uterine hæmorrhage. Other observers scarcely subscribe to this statement but place stress upon interference with abdominal movements of respiration. As many of the cases occurred at or very near the menstrual period

the value of uterine hæmorrhage may be questioned.

Slight cases may clear up in a few days but the severer types offer no such happy result. Wilson thinks interruptions of the menstrual periods from "cold" with severe pains, so common in young girls, are often cases of ovarian hæmorrhage.

Probably careful analysis of a case would permit differentiation of the varieties, as in early infancy and early menstrual activity the follicular variety would be most likely and the corpus luteal and stromal to be least common. As infections become more common in later years the incidence of the stromal variety would seem to be increased. Moreover, stromal and corpus luteal hæmorrhages would not be so common at or very near the menstrual period.

Clinical observation bears out this statement. In the stromal variety a history of irregular or delayed menstruation is present and to this is often added evidence of long standing pelvic disease. In several instances the history was strikingly significant of tubal pregnancy. I have a very strong conviction that the diagnosis of ovarian hæmorrhage will be as clear as of ectopic gestation and its subdivisions easier to differentiate than are tubal abortion and tubal rupture.

DIAGNOSIS

In but few cases have correct diagnoses been made before operation or autopsy. One can most easily realize this fact by reading Primrose's paper and the discussion of it in the thirtieth volume of the transactions of the American Surgical Association (1912). Research of the literature presents an alarming picture with its reports of cases of ovarian and tubal hæmorrhage that had symptoms calling for immediate surgical treatment or having a rapidly fatal termination without previous recognition. Many have first been suspected at autopsy. Probably many in the future will not be decided by either of these procedures alone. In these the microscope will be of paramount importance in making the positive diagnosis. This statement has been indelibly impressed upon me by its use in my doubtful cases of ectopic gestation. In 1897, I brought this matter to the attention of the Southern Surgical and Gynecological Association and in 1914 to that of the Gynecological Section of the American Medical Association. Last year I again presented it to the first named organization. This, then is my fourth paper on the subject, written as an appeal to my confrères for more attention to be given to the subject of ovarian and tubal hæmorrhage not due to pregnancy. It must be distinguished from tubal pregnancy, ulcer of the intestine, appendicitis, and ingestion of poisons. I need not dwell upon this phase of the subject. My paper of 1904, referred to was based upon 10 cases of supposed ectopic gestation in which the microscope refuted the diagnosis. In December, 1917, I reported upon 19 later cases, 15 tubal and 4 ovarian, with the same postoperative provisional diagnosis. Microscopical reports on these reject 13 tubal and all of the ovarian cases. I am confident several of these cases had as much local evidence of pregnancy as many I have seen in the hands of others in which the microscopical diagnosis was accepted without question. One can easily appreciate the rank injustice of such an incomplete diagnosis in virgins and widows.

PROGNOSIS

I have already referred to the tragic character of many cases of these forms of intraperitoneal hæmorrhage. Their gravity may be appreciated when it is recalled that many of the foremost abdominal surgeons of the last 40 years have done emergency operations for their relief under the diagnosis of ruptured tubal pregnancy, appendicitis, etc. Among these may be mentioned Alban, Doran, Edgar, Galabin, Hind, J. A. Lee, and Tate. Depage reports a case of intraperitoneal rupture of an ovarian hæmatoma in which he promptly operated with a diagnosis of acute appendicitis with perforation. Primrose reports 2 cases which I have abstracted as follows:

CASE 1. A woman of 35 years, mother of twins of 3½ years, her only pregnancy; lifted a heavy chest two days before a menstrual period was expected and experienced sudden, severe pain

in the hypogastrium, nausea and vomiting. He found her twelve hours later anæmic, having a pinched and anxious expression, temperature 99.6° F, and pulse 130, marked abdominal distention and uniform rigidity. Palpation at once induced vomiting; general abdominal tenderness but most marked in left lower quadrant. Abdominal section revealed a very large quantity of blood in the abdominal cavity and a ruptured hæmorrhagic cyst in the left ovary from which arterial blood was spurting in a pulsatile fashion.

CASE 2. Exceptionally active woman of 40 years two days before a menstrual period was due was awakened at 2 a. m. with pain in abdomen. Seen 16 hours later the temperature was normal but severe local pain and vomiting were present. Operation four hours later for appendicitis, through right lateral incision. Fluid blood welled up into the wound and a midline incision was made. A large amount of blood, fluid and coagulated blood was found. The right ovary, considerably enlarged, contained a ruptured follicle from which the hæmorrhage occurred. No microscopic evidence of pregnancy or malignancy was found.

Bloodgood reports two cases of pelvic hæmatomata in which operation with a provisional diagnosis of appendicitis was done one day before the menses were due; one was tubal and the other ovarian in origin. Ellsworth reports a case of a girl of 18 years operated on in first 24 hours for appendicitis. The appendix was found to be normal and there was notable intraperitoneal hæmorrhage. A small laceration was found in the fallopian tube one inch from fimbriæ and from it bleeding was continuing. The microscope revealed no evidence of pregnancy. Leonard Freeman reports the case of an athletic young woman, who, in vaulting over a fence, experienced violent pain in the lower part of the abdomen and went into collapse. The abdomen was opened and the fallopian tube found torn near its middle. The uterus and appendages appeared otherwise normal with no evidence of pregnancy.

RELATION TO PELVIC HÆMATOCELE

Pelvic intraperitoneal hæmorrhages of various structures go to make up the immediate causes of pelvic hæmatocele. But nongestational tubal and ovarian hæmorrhage next to tubal pregnancy, are the chief causes and should always be considered in connection with such hæmatocele. Particularly is this true when such elements as ingestion of poisons, oxytoxics or emmenagogues; early menstrual life or postclimacteric; trauma or general conditions earlier mentioned occur.

TREATMENT

In the milder forms of the condition rest and anodynes may meet all indications. In the severer forms the same rules apply as are employed in treating ectopic pregnancy.

CLINICAL DATA ON CHORIO-EPITHELIOMA WITH END-RESULTS OF OPERATIVE TREATMENT[1]

By HIRAM N. VINEBERG, M.D., F.A.C.S., New York

THERE probably is no more interesting topic in the whole domain of gynecology than that of chorio-epithelioma. An entirely physiological process, by slightly overstepping its bounds, becomes, at once, a highly malignant condition with rapid and extensive metastases. Although it is generally associated with gestation, it may, nevertheless, occur in individuals in whom pregnancy can positively be excluded, as, for example, in a very young female, or in a male. Its development, under these conditions, forms a most interesting chapter in pathology. Another curious feature is its occasional development, originally in areas more or less remote from the site of the ovular implantation, while this remains free from the process. These and several other points in the pathology of the condition form a very tempting topic, but as they have already been so fully discussed in the literature by distinguished and capable pathologists, the writer felt it would be more within his powers to take up the clinical side, which, until now, has been very much neglected. His contribution upon this aspect of the subject is based upon nine personal cases and upon a close and rather extensive study of the literature. It is generally agreed that there are two varieties of chorio-epithelioma, the one highly malignant, the other semi-benign. The chief interest to us as clinicians is: Are there any means of distinguishing the one from the other? Marchand, who undoubtedly is the greatest authority upon the subject, and who, as we all know, has done so much to establish its pathology, frankly confesses he has failed to recognize any histological differences between the two varieties. A few pathologists, however, notably V. Velits, Robert Meyer, and Ewing, have attempted to point out features of differentiation, but their observations have not been confirmed by others. Several eminent pathologists, whom the writer has personally interviewed, emphatically stated they were unable to recognize any histological differences. The consensus of opinion, therefore, at present is that there are no definite histological features characterizing the one variety from the other.

Frequency. The number of cases recorded in the literature has been variously stated. For instance, Péry, in 1910, stated there were 700 cases on record. He has been frequently quoted. The figures are entirely too high. Pollosson and Violet, in 1913, made a very careful collection of the recorded cases and they accept Briquel's collection, in 1903, of 217 cases. From that date until 1913, they collected 238 more cases, making in all 455 cases. From 1913 up to the end of 1917, the writer has found recorded in the literature 69 cases which with his series of 9 cases make a total of 78 cases. Of course, it must be borne in mind that during this period the literature coming to us from Germany and Austria has been very scant.

Etiology. With very few exceptions, pregnancy has preceded the development of the growth; it is, therefore, essentially a disease of fertile women. But, as Teacher states, whether race, climate, or social conditions exert any influence upon its occurrence, we do not, at present, know. The ages at which it has occurred have varied from 17 to 55 years. In the series of 189 cases tabulated by Teacher in 1903, the average age was 33 years, 57 per cent of the total number occurred between the ages of 20 and 40 years, but there were 6 cases below 20 and 9 cases over 50 years.

In the writer's series of 78 cases, 4 were under 20 years; 13 were between 20 and 25; 21 were over 40 years, of these 8 were 50 and over.

The number of cases below 20 years and over 50 years is of great interest, and undoubtedly has some bearing upon the fact that hydatid mole which is the most frequent cause of the growth, is more often met with

Read before the American Gynecological Society, Philadelphia, May 17, 1918.

at the extremes of fertile life. Another factor of interest is that the frequency of the disease runs parallel with the degree of fertility.

In 156 cases of Teacher's series, in which the necessary data were available, 5 per cent occurred in connection with the first pregnancy, 15 per cent with the second pregnancy, 28 per cent with the second or third pregnancies. On the other hand, Briquel's 158 cases in his series of 181, give a much higher percentage with the second and third pregnancies: 33, or 21 per cent, with the second pregnancies; 31, or 20 per cent, with the third pregnancies; and 74, or 47 per cent, with the fourth or more pregnancies.

It is interesting to note the period elapsing between the last pregnancy and the development of the disease; in other words, the period of latency. This very often is not easily defined, as it usually has to be based upon the occurrence of the first symptom, which is generally hæmorrhage, or upon the appearance of a characteristic tumor in the vagina or vulva.

The period of latency, in the cases recorded has varied from a few weeks to several years; the longest period stated is 21 years.

Many writers doubt the accuracy of the long period of latency stated in several cases. They assume that a miscarriage of an early gestation had been overlooked. Be that as it may, there are some cases with incontrovertible evidence that several years elapsed between the last possible gestation and the development of the growth. Such a case is reported by Kroesing.[1] The patient was 52 years of age; 5½ years before, the uterus had been emptied of a hydatid mole; 2¼ years later, both ovaries were removed. At this time the uterus looked perfectly normal. Following the operation there was a complete cessation of the menses, 3¼ years later, and 5½ years after the hydatid molar pregnancy, the uterus was removed for metrorrhagia and was found to be the seat of chorio-epithelioma.

Bearing upon this point, Emil Ries, of Chicago[2] has made a most interesting and unique observation. In a uterus containing several fibroids that he removed from a woman who had not been pregnant for 18 years, he noticed a long thread-like formation hanging from the left uterine horn. This, on microscopic examination, proved to be a vein containing degenerated chorionic villi. No chorionic epithelia were found on these villi, which, according to Dr. Ries, would account for the non-development of chorio-epithelioma in that instance. The finding demonstrated beyond a question, the long period (in this instance 18 years), during which chorionic villi may remain latent in the system.

There cannot be much doubt that in many of the cases reported with a latent period of a few weeks, the growth had already existed before the termination of the pregnancy. In our Case 8, the growth was detected with the exploring finger, after manually emptying the uterus of a hydatid mole. Similar cases are reported by Eden,[3] Kelly and Workman.[4] In Pick's[5] famous case, the growth in the vagina developed during the presence of a hydatid mole in the uterus (fourth month of gestation). Wallart reported a metastatic growth in the eighth month of pregnancy. Von Rosthorn, Poten and Wasmer, each observed a metastatic growth in the vagina before the expulsion of a hydatid mole. The case reported by Jellinghaus[6] evidently belonged to this class. The patient was curetted for a hydatid mole. She continued to bleed, was again curetted and then subjected to a hysterectomy, five weeks after the first curettage. A growth was found in the uterus. Jellinghaus, in the writer's opinion, evidently failed to recognize the significance of the course of events in his case, otherwise he would not make the recommendation that every case of hydatid mole should be subjected to a second curettage, three weeks after the first, to ascertain whether any cystic villi are present, and if found, hysterectomy should be done.

But the treatment of hydatid mole, in reference to chorio-epithelioma, will receive attention later on. Bovée[7] reports an interest-

[1] Arch. f. Gynaek., 1909, lxxxviii, 469.
[2] Am. J. Obst., N. Y., 1913, lxvii, 433.
[3] Proc. Royal Soc. Med., Lond., 1913–14, vii, 146.
[4] Glasgow M. J., 1906, Sept.
[5] Berl. klin. Wchnschr., 1897, Nos. 49 and 50.
[6] Am. J. Obst., N. Y., 1917, lxxvi, 141.
[7] Surg., Gynec. & Obst., 1915, xx, 405.

ing case in this connection. In a fibroid tumor of the uterus, complicated with pregnancy, which he removed, a chorio-epitheliomatous growth was accidentally found in the wall of the uterus.

A most important consideration is the nature of the pregnancy preceding the disease. In Teacher's series of 188 cases, 73 cases, or 35 per cent, followed hydatid mole; 59 cases, or 31 per cent, followed abortion; 49 cases, or 28 per cent, followed labor at or about term; 7 cases, or 4 per cent, followed extra-uterine gestation.

In Pollosson and Violet's series of 455 cases, including Briquel's series of 217 cases, 203 cases, or 45 per cent, followed hydatid mole; 135 cases, or 30 per cent, followed abortion; 99 cases, or 21 per cent, followed labor at term; 12 cases, or 2.5 per cent, followed extra-uterine gestation; 6 were doubtful.

In Hitschmann and Cristofoletti's series of 240 cases, 116 cases, or 48 per cent, followed hydatid mole; 73 cases, or 30 per cent, followed abortion; 51 cases, or 21 per cent, followed normal labor.

They also give statistics of 200 cases of hydatidform mole, of which 15 or 7.5 per cent were followed by chorio-epithelioma. Teacher is of the opinion that this figure is too high; as five of the cases were recorded by Kromer, and as they all recovered after operation, he is inclined to question the validity of the diagnosis of malignancy. Omitting these cases of Kromer, the percentage is 5, which Teacher thinks is still too high.

Symptomatology. The most characteristic and prominent symptom is uterine hæmorrhage. This, as a rule, is very profuse and may even be alarming, as occurred in one of my cases (Case 1). The second hæmorrhage was so great that the patient became markedly exsanguinated in a few minutes, and it appeared to me, she would have bled to death, if I had not at once packed the uterus and vagina tightly with gauze.

However, in many instances, the bleeding may be only of moderate amount, but protracted, simulating that which accompanies ordinary placental or decidual residue. As a rule, the patient is subjected to a curettage, but it is found that the bleeding soon recurs. This of itself should excite suspicion. But it is not uncommon to read in the literature of cases that had been subjected to as many as four or five or six curettages, before the condition was suspected. The persistence and, at times, very abundant bleeding soon lead to marked anæmia, with its train of symptoms, cachexia becomes manifest, the patient feels and looks ill, and a septic condition may intervene. The latter is particularly prone to occur when several curettages have been done. This occurred in one of the writer's cases (Case 7), the only fatal one in the series.

In growing the tumor occasionally perforates the uterus; then there may be a most profuse intraperitoneal hæmorrhage, simulating ruptured tubal pregnancy of the catacylsmic type. T. Wilson[1] reports a case of this kind and a few others are found in the literature. In very rare instances, even when the growth is situated at the placental site, bleeding may be entirely absent, as in a case reported by Lichtenstein.[2] Even amenorrhœa of three or four months' duration, has been observed in a few cases (Eden, Cataruni, and others). This singular phenomenon has been observed only in cases following hydatid mole. Pollosson and Violet[3] draw attention to the presence of colic-like pains, caused by the expulsion of blood clots or of débris of the growth. A dull pain is an accompaniment of the later stages of the disease, when the broad ligament becomes involved. Hæmoptysis is an important symptom and may manifest itself comparatively early in rapidly advancing cases. It usually indicates the presence of pulmonary metastases (Teacher). In some instances, when the symptoms, referable to the genital tract, were not distinct or absent, a diagnosis of pulmonary phthisis was made.

In many cases, an early evidence of the disease is the appearance of characteristic tumors in the vaginal walls, most frequently in the anterior wall, near the urethral meatus. These may vary in size from that of an almond to that of a hen's egg. When they attain the

[1] Proc. Royal Soc., Lond., vi, 224.
[2] Zentral. f. Geburtsh., 1908, No. 8, 261.
[3] Ann. d. gynéc., 1913, 2d series, x, 2571.

latter size they are usually single. They possess a deep bluish color and appear very vascular. In other instances, several small papules will appear in the vaginal walls, preferably on the posterior wall, corresponding in size to that of a split pea. They have the characteristic bluish appearance and seem as if they were situated beneath the vaginal mucosa. The uterus is usually found enlarged, the degree of enlargement varying from that corresponding to the gravid organ at six weeks, to that at twelve weeks. The cervical canal may be patulous, readily admitting the index finger, thus permitting an exploration of the cavity. The growth then will be felt as a hard nodule of variable size, with a distinct excavation in the center. When it can positively be concluded that the excavation had not been artificially produced by a previous curettage, one is safe in making the diagnosis of chorio-epithelioma. In one of the writer's cases (Case 8) he was able to reach the correct diagnosis on the strength of this finding, even in the face of a negative report by the pathologist, from an examination of the curetted material. But not infrequently the uterus may not be appreciably enlarged, the growth being of very small dimensions, as has been recorded in several cases in the literature. The writer, in his series, met with one instance, in which the growth was no larger than a cherry, and was situated beneath the peritoneal covering, near the left cornu, the uterus, in that instance, naturally, not being perceptibly enlarged.

In some of the cases recorded in the literature, there was an entire absence of symptoms referable to the genital tract, the first manifestation of the disease being symptoms due to a cerebral or spinal tumor, or to pulmonary metastasis. A. Straume[1] reports a case diagnosed as pulmonary tuberculosis, on account of hæmoptysis, dyspnœa, and pain in the chest. There was no bleeding from the genitals, neither was there a history of a hydatid mole, abortion, or labor at term.

A. Kedrierski[2] reports a case in which paraplegia developed eight months after last delivery at term. At the autopsy a chorio-epitheliomatous growth was found in the spinal cord, at the level of the fourth lumbar vertebra. Similar growths were found in the lungs, liver, and both ovaries. The uterus and vagina were entirely free of growths.

Chorio-epithelioma in connection with ectopic pregnancy. There are 13 cases recorded in the literature of chorio-epithelioma in the tube. The resulting mass has varied in size from that of a hen's egg to that of an adult head. The tumor is very friable and exceedingly hæmorrhagic. The histological features are the same as those of chorio-epithelioma of the uterus. Metastases are very frequent. Chorio-epithelioma of the tube has always been a discovery at operation, or on autopsy. It seems to have a more rapid course and a more rapid extension than chorio-epithelioma of the uterus.

Ectopic growths. While the usual site of chorio-epithelioma is in the body of the uterus, the growth has developed primarily in other situations. Sternberg[3] reported a case in which the growth involved the vaginal portion of the cervix, the remainder of the uterus being free of any growth. The endometrium showed a decidual reaction. The last pregnancy ending in an abortion, occurred 7 years before.

METASTASES

Metastases in chorio-epithelioma are of very frequent occurrence. They appear at a varying period and sometimes occur at a very early stage. In the case of Poten and Vassmer, two vaginal tumors were excised five days before the presence of a chorio-epithelioma was detected in the uterus. Metastases have been observed in nearly all the organs. In these cases the metastases take place through the blood-current. Most commonly a fragment of the neoplasm enters the blood current, passing through the heart, and arrives in the lungs where it is disseminated to all the organs. But in the case of the organs in the genital sphere the metastases reach them through the venous anastomosis of the pelvic organs.

Robert Proust and Xavier Bender in their very excellent paper on chorio-epithelioma

[1] Petersburg med. Wchnschr., 1910, No. 28.

[2] Gaz. lek., Warsaw, 1912, No. 39.

[3] Zentralbl. f. Gynaek., 1907, No. 48, 1511.

have presented a very full description of metastases, to which I am indebted for many of the following data.

Metastases in the lungs are most frequent and their number and size vary very much. Occasionally only one tumor is found which may acquire very large dimensions, or more frequently numerous small nodules are found scattered over the entire lung. The most favorable sites are the apices and the bases. The middle lobes are less frequently involved. These metastases may develop insidiously and give no evidence of their presence until found at autopsy. This absence of clinical evidence is dependent upon the site, number, and volume of the secondary growths.

In the case of Lindfors[1] and Morison[2] the secondary growths developed to a relatively enormous size.

Next to the lungs, the vagina and vulva are the most frequent sites of metastatic growths. On account of their situation they are the most easily discerned. Occasionally a single isolated tumor only is present, but more frequently there are numerous small nodules running together forming almost a ring. Their form and their dimensions are most variable as also their location. They may involve the entire vaginal canal or they may occur only at the vulvar orifice or in the folds of the labia majora. They usually occur in the form of small nodular masses underneath the mucosa characterized by their brown or violet discoloration. They have been justly compared to thrombosed varices which they resemble so closely as to be frequently mistaken for them. The consistency is tense and elastic, almost fluctuating at times. These tumors grow very rapidly causing necrosis and irregular ulcerations. Occasionally these ulcerations are clean cut and well defined. The vaginal growths when they undergo ulcerations may be attended with profuse and obstinate hæmorrhages. They very soon become infected and give rise to a sanious and fetid discharge. The period of the appearance of the vaginal metastases varies considerably. Occasionally they appear in the later stages of advanced cachexia, but in some cases they occur remarkably early and furnish a valuable diagnostic sign.

Uterine ligaments, tubes, ovaries. The broad ligament is frequently found infiltrated by nodular masses of smaller or larger size. The invasion of the tubes and ovaries is occasionally characterized by small discrete growths discovered only on histological examination. At other times the growths may reach a considerable size, readily distinguished by their reddish brown or dark color and their hæmorrhagic aspect on section.

Liver. Secondary growths in the liver are frequently found at autopsy. Generally the nodules are found disseminated, of a size varying from that of a pea to a small nut. In a case reported by Hitschmann, the entire liver was literally riddled with metastatic nodules. Paviot observed a case in which there was a tumor 4 centimeters in diameter on the convex surface and a large number of other growths in the depth of the liver. These metastatic growths generally do not give rise to many symptoms. Krawer and Macaggi have noted an increase in the volume of the liver, but the existence of a secondary tumor the size of a fœtal head was not even suspected in a case of Schmorl's.

Kidneys, urinary passages. Nitzel, Tibaldi Gottschalk, and many others have observed secondary growths in the kidneys, but the growths usually remained latent. In a case of Davis and Harris, a tumor in the left kidney 6 centimeters in diameter did not give rise to a single symptom. The exception occurred in a case of Gottschalk in which the urine contained characteristic plasmodial masses. In this instance, it is true, the tumor attained the size of a fœtal head. Secondary growths have very rarely been observed in the ureter (J. Schmidt), in the bladder (Jacubasch, Krawer, Perski, Marchand), and in the ureteral wall (Holzappel).

Metastases in the central nervous system are also frequently seen to occur most often at the level of the left hemisphere, and the most common site is the occipital lobe. They are sometimes found as a single nodule varying in size from a lentil seed to a hen's egg. In other instances they occur in multiple nodules. These secondary growths do not

[1] Zentralbl. f. Gynaek., 1901, No. 21, 567.
[2] Tr. Obst. Soc., Lond., 1890, xxxviii, 130.

usually have the hæmorrhagic aspect of visceral metastases.

In addition to these sites metastases have been occasionally observed in the most diverse organs, as for instance in the stomach, large and small intestines, heart, pericardium, pancreas, spleen, thyroid, suprarenal capsules, diaphragm, bone and subcutaneous cellular tissues.

DIAGNOSIS

The diagnosis of chorio-epithelioma is often beset with great difficulties. One should always suspect it when profuse hæmorrhage follows a hydatid mole that has been thoroughly removed. To be certain of this, one must employ the procedure advocated by the writer, some years ago; that is, in every case of hydatid molar pregnancy, to perform a hysterotomy, so that the hand may be employed to remove all the vesicles. Another inestimable value of this procedure consists in enabling the operator thoroughly to palpate every portion of the inner wall of the uterus for any suspicious nodule, or extra thinning of the wall, at any one area. In this manner the growth may often be detected in its very earliest stages, as was done by the writer in 2 cases, in his series, and by Eden in one case. For there can be no question, judging from a close scrutiny of the reported cases, that chorio-epithelioma was not infrequently present while the hydatid mole was still in the uterus. It is safe to place in this category most of the cases of hydatid molar pregnancy, in which the bleeding persisted, or recurred shortly after the uterus was emptied. The case reported by Jellinghaus, already referred to, in the writer's opinion, belongs to this class. If this assumption be correct, then the advice given by Jellinghaus and others, to subject every woman who has had a hydatid mole, to a curettage, every two or three weeks, to determine whether she is developing a chorio-epithelioma, would obviously be unnecessary, to say nothing of the dangers such a procedure would involve. H. Williamson[1] makes the suggestion that the Abderhalden test be made, every few weeks, in every woman who has a hydatid mole, so as to determine the earliest development of chorio-epithelioma. But it must also be borne in mind that in a few cases, a period of amenorrhœa intervenes between the removal or expulsion of a hydatid mole, and the first symptoms of the presence of a growth. In Eden's case a period of two months and in Cataruni's case 3 months elapsed. No explanation has been offered for this paradoxical phenomenon. In Eden's case, the growth was evidently present at the time of the hydatid mole, as when he emptied the uterus he detected a small nodule on palpation and thought it was a fibroid nodule.

When the growth follows shortly after labor at full term, the cervical canal is usually patulous. Then it may be feasible to palpate the interior of the uterus with the finger or fingers. The detection of an elevated, fairly hard, nodule with an excavation in the center is almost pathognomonic. The appearance of the characteristic bluish red papules on the vagina or in the vulva, confirms the diagnosis. When the cervix is not patulous, other means have to be employed, which will receive attention later.

The greatest difficulties are encountered when the growth follows an early miscarriage, for in these instances one can never be certain that the persistant bleeding may not be due to placental or decidual residue, even though the curettage may have been done by an expert. In such a contingency, one must have recourse to a microscopic examination which, unfortunately, even by the expert, may not be conclusive, or may even be misleading. Several cases are recorded in the literature in which the microscopic examination by a pathologist of repute and ability, proved to be inconclusive or erroneous. The writer has already referred to an instance of his own, in which a most capable pathologist made an error in diagnosis. When we stop to consider the nature of the condition, we can readily understand how a microscopic examination may be attended with failure. Unless the curette scrapes away some of the deeper tissues, the pathologist has no means of determining whether he is dealing with a new-growth or with normal placental tissue. He can only determine this, if the microscope

[1] Proc. Royal Soc. Med., Lond., 1913–14, vii, 146.

shows invasion of the deeper structures, for that is the only distinguishing feature between normal chorionic tissue and chorio-epithelioma. To add to the difficulties, a curettage done so as to bring away some of the deeper tissues is not free from danger. It is prone to set free particles of the growth, which may gain entrance into the venous circulation and then bring about rapid and extensive metastases. A close scrutiny of the cases in the literature reveals the fact that the most rapidly fatal cases were those that were subjected to several curettages before a diagnosis was reached and a hysterectomy performed.

Hitschmann and Cristofoletti lay great stress upon the dangers attendant upon a curettage in chorio-epithelioma. They studied 300 cases in the German literature, and made a comparison between the cases subjected to a curettage and those that were not. In the former, they found that metastases were very much more extensive and rapid than in the latter. They found, also, that the fatal, non-operative cases, had fewer metastases than those subjected to hysterectomy, which terminated in death at an early date. Thus demonstrating that any manipulations of the affected tissues are likely to cause extensive metastases. In studying the reports of the cases in the literature, one cannot fail to observe how much better the results were, when the radical operation had not been preceded by two or three or more curettages, as obtained in many of the cases. The unusually excellent results obtained by the writer, in his series, 8 recoveries in 9 cases, cannot well be explained by the mere assumption that the cases were all of the semi-benign variety. That would be a fortuitous occurrence, not to be paralleled by a series of a similar number of cases, in the literature. It is more within reason to attribute them to the circumstance that the diagnosis was made at an early stage of the disease, than that in every instance the growth was of the non-malignant type.

The only fatality in the series occurred in the case that was subjected to two curettages, the pathological report of the first being misleading, although a tentative diagnosis, on the clinical evidences, had already been made by the writer. In spite of all these considerations, instances will arise where recourse will have to be taken to a diagnostic curettage. The clinical evidence may not be conclusive, it may justify only a suspicion, and one would under these conditions naturally hesitate to remove the uterus in a young woman, without having incontrovertible evidence of the presence of the disease. But if any aid in diagnosis is to be sought from the material obtained by a curettage, one must make sure that the curette has brought away some of the deeper structures, as already has been stated. Occasionally, in a doubtful case, especially in a young woman, one might adopt the method employed by the writer in a case recently.

The patient, aged 26 years, had had a miscarriage of twins, at about the third month, 6 weeks before. She was curetted in a metropolitan hospital on the same day. She continued bleeding, at times quite profusely. The uterus was but slightly enlarged, she was now again curetted, the pathologist reported that the tissues were suspicious of chorio-epithelioma, but he could not be certain of the diagnosis as there was no myometrium in the material. The bleeding recurred in a few days. Not wishing to subject the patient to another curettage, the writer did a vaginal hysterotomy and also anteverted the uterus through an anterior vaginal incision. In this way he was able to palpate and inspect with the naked eye both the inner and outer walls of the uterus. No growth or suspicious area was detected. The wound, in the uterus, was sutured, the organ was replaced in the pelvic cavity and a suture applied to the vaginal wound. The patient has been under observation for over 3 months; she has been perfectly well and menstruation has been normal.

The growth may be situated entirely in the uterine wall or projecting toward the peritoneal surface, and has no connection whatever with the endometrium, as in a case reported by H. Meyer[1] and another by Nagy[2]. Hence the necessity of exploring both surfaces of the uterus.

PROGNOSIS

There is no form of malignant new-growth, in which the prognosis varies so widely as in chorio-epithelioma. If the diagnosis has been made early, and the uterus has not been subjected to much manipulation, as is occasioned by several curettages, the prognosis is fairly

[1] Zentralbl. f. Gynaek., 1914, iv, 382.
[2] Arch. f. Gynaek., c, No. 2.

good. Different from other malignant growths the outcome may be good, even in the face of extensive metastases. Several cases are on record, in which there were evidences of metastases in the vagina and lungs, and the patients recovered with and without operation. A remarkable instance of this kind is a case reported by J. C. Rockafellow[1] in which, after removal of the uterus, large growths recurred in the labia, at intervals of a few weeks. As soon as the growths, sometimes the size of a kidney, were excised, they would spring up again like mushrooms, in a week or so. On the fourth recurrence, the patient's general condition was so poor that it did not seem worth while to make any further attempts at removal. To the surprise of every one, in a few weeks, the growths spontaneously began to shrink and in a few weeks more, had practically disappeared, leaving a mere hard ridge at their site. The patient began to improve and in a short time regained good health and remained so as long as she was under observation, which was a period of over two years.

Von Fleischman,[2] Hormann[3], Hitschmann and Cristofoletti (loc. cit.), each report similar cases. In Hitschmann and Cristofoletti's case, the operation was given up on account of the extent of the tumor, which involved the vagina and bladder, and extended far and wide, in the pelvis. The patient improved rapidly after the operation, and a month later there were no signs of the tumor of the uterus, and the pelvic structures seemed to be free. The patient was in perfect health, seven years later. In one of the writer's cases (Case 4), several small bluish papules appeared on the posterior vaginal wall, after the hysterectomy. These gradually disappeared spontaneously. Neumann,[4] Kelly and Teacher,[5] Marchand, have each observed spontaneous disappearance of vaginal metastases after removal of the uterus. Risel,[6] Eden and Lockyer,[7] reported the observation of healed nodules in the lungs, among those still growing, in a case which terminated fatally. Teacher, himself, publishes a similar observation.

Regarding operative results, the statistics published by Teacher (loc. cit. p. 590) exhibit the most careful study. In the 189 cases collected, radical operation was performed 100 times. Of the group not operated upon all ended fatally except the case of von Fleischman. Of the 100 cases operated upon, 63 were followed by immediate recoveries, and 37 by death; of the 37 deaths, 12 occurred within a few days, evidently from shock and loss of blood. In the remaining 25 there was no marked improvement, or interval of good health after the operation. "Out of the 63 recoveries, 32 were reported well six months or more, after the operation, and out of this number 24 remained well for more than a year, and of these again, 13 were reported well more than two years after the operation. Among the fatal cases, it was remarkable that in 5 only, did the disease recur after a longer interval than six months, and the longest interval between operation and death was one year. Death after a longer interval has since been reported." Teacher goes on to say: "Still, one is justified in the conclusion that, if the patient survives more than six months without signs of recurrence, the probability of recovery being permanent is considerable; after one year, it is very great, while cases in which two years have elapsed may be regarded as absolute recoveries."

Teacher draws attention to the striking fact that 42 of the cases, with a percentage of recovery of 78, followed hydatid mole. He adds, "Possibly a considerable number of these should not have been described as chorio-epithelioma malignum."

Briquel reported 114 cases with 72 operative recoveries and 42 deaths. Of the 181 cases collected by Pollosson and Violet, there were 126 operative recoveries and 17 deaths from operation. The difference in the operative recoveries, in the two series, could well be explained by the difference in the periods in which they were performed, the one period extending from 1885 to 1903, the other from 1903 to 1912.

[1] Tr. Ia. St. M. Soc. 1915, v, 428.
[2] Monatschr. f. Geburtsh. u. Gynaek., 1903, April.
[3] Beitr. z Geburtsh. u. Gynaek., 1904, viii, 3.
[4] Monatschr. f. Geburtsh u. Gynaek., 1897, vi, 17.
[5] J. Path. & Bacteriol., 1898, p. 358.
[6] Quoted by Teacher. New System of Gynecology.
[7] 1917, vol. ii, p. 587.

Briquel analyzed this series, in reference to the operative results, following the different kinds of pregnancy. In 21 cases following labor at term, there were 12 (57 per cent) recoveries, in 34 cases following miscarriage, there were 20 (58.5 per cent) recoveries, in 54 cases following hydatid mole, there were 37 (68.5 per cent) recoveries, in 3 cases following tubal gestation there was 1 (33.3 per cent) recovery.

The writer is inclined to agree with Pollosson and Violet, that the better results obtained in cases following hydatid mole are probably due to the circumstance that the cases are watched more closely, and the diagnosis, in consequence, is made at an earlier stage.

Before taking up the treatment of chorio-epithelioma, it may be well to devote a short time to the consideration of the treatment of hydatid mole in view of the close connection between the two conditions. This close relationship between hydatid mole and chorio-epithelioma was first established by Marchand in 1895. The frequency with which hydatid mole is followed by chorio-epithelioma has been variously stated by different writers. Bumm in his textbook placed it at 15 per cent. Palmer Findley[1] in a collection of 210 cases found it to be 16 per cent. On the other hand, in 20 cases observed at the Kiel Klinik, only two were followed by chorio-epithelioma. Kehrer[2] followed up the history of 50 cases of hydatid mole and did not meet with a single instance of this complication. The writer, during a period of four years prior to 1911, had observed 8 cases of hydatid mole, 3 of these were attended or followed by chorio-epithelioma. Senarclens (quoted by Pollosson and Violet) was enabled in the Canton of Vaud to observe for a long period of time, 42 out of 49 cases; 35 or 72 per cent were definitely cured by the expulsion or removal of the hydatid mole, 7 or 14 per cent underwent immediate cure, but the remote results were unknown. Three only, or 6 per cent, died from chorio-epithelioma. It is obvious that statistics, such as these, furnish a more reliable basis as to the relationship between the two conditions than do those coming from hospitals or operators. But granting even that the higher percentage expresses more closely the actual relationship, it would scarcely warrant the attitude of some authorities, that all cases of hydatid mole should, at once, be subjected to a panhysterectomy. When a hydatid mole occurs in a woman over 40 years of age, as not infrequently is the case, it may be the safer course to resort, at once, to hysterectomy, rather than wait for the development of chorio-epithelioma. But it occurs almost as often in young women, ranging from 18 to 25 years, in whom an unnecessary sacrifice of the generative organs would be most reprehensible. Hence, in women, let us say, under 40 years of age, the course advocated by the writer, in a paper[3] read before the New York Obstetric Society, May, 1911, ought to be followed. This, as has already been described above, consists in performing a vaginal anterior hysterotomy, for the double purpose of making certain of removing all vesicles, and of making a thorough exploration, with the hand, of the entire inner walls of the uterus. The woman should then be carefully observed for a long period, and on the occurrence of profuse bleeding, a diagnosis of chorio-epithelioma would be justified.

The treatment of chorio-epithelioma, once the diagnosis has been made, resolves itself into an immediate panhysterectomy, for, as we have already shown, we have no means of determining whether the individual case be a highly malignant one, or one that might undergo spontaneous cure. The latter contingency is so unusual that for all practical purposes it must be left out of consideration.

When the growth is discovered while emptying the uterus of a hydatid molar pregnancy, the natural thing to do would be to complete the operation through the vaginal route. The same would apply when, in a doubtful case, an exploration of the inner and outer walls of the uterus would be made through a vaginal incision. In most all other instances, the abdominal route probably is to be preferred, for it embraces less traumatism and consequently less danger of causing metastases.

[1] Am. J. M. Sc., 1903, p. 486.

[2] Arch. f. Gynaek., 1894, xcv, 487.

[3] Am. J. Obst., N. Y., 1911, lxiv, No. 3

Hitschmann and Cristofoletti lay strong emphasis upon the selection of the abdominal route for this very reason, and also because they deem it advisable to excise the deep pelvic veins, as is done in puerperal thrombophlebitis. They assert that the pelvic veins are frequently filled with extensions from the growth. Hence, the necessity of this excision. Should this even be the case, it is doubtful whether the procedure is called for, inasmuch as these venous extensions have a tendency to disappear spontaneously by clotting of the blood, depriving the tumor masses of their source of nourishment. Vaginal nodules, if present, should be excised and, if they occur subsequently, the same procedure might be necessary, although they also have a tendency to disappear spontaneously. Different from carcinoma, the lymphatic vessels and glands are seldom involved, and there is no indication for doing anything so radical as the Wertheim operation. One should not defer doing the operation, in the face of the most unpromising local conditions, for extensive infiltrations are usually due to venous involvement which, as we have seen, has a tendency to disappear spontaneously after removal of the uterus. Even when there are signs of metastases in the lungs, hysterectomy should not be denied, if the patient be in a condition to withstand the shock of the operation, for there are several cases on record, in which the lung symptoms have disappeared, after the original growth had been removed.

Radium has been employed in a few instances,[1] but with only temporary benefit.

CASE 1.[2] Mrs. E. R., a patient of Dr. Altman, was seen by me January 4, 1907. She was 47 years old, married 26 years, had had eight children, the last seven years ago; one miscarriage 16 years ago. She enjoyed good health, and menstruation had been normal until the present illness. Her last regular menstruation occurred September 27, 1906. On November 10, when she was 17 days overdue, a bloody flow occurred, resembling in amount and duration her usual menses. But the blood did not cease entirely. She continued staining and 12 days before I saw her she had a profuse flow lasting one day, and passed several large clots. She had no abdominal pain until the day of my visit, when she referred it to the lower part of the abdomen and stated that it was moderately severe. Three weeks before, while mounting a flight of stairs she felt a severe fluttering in the cardiac region, and suffered from shortness of breath. She has suffered, more or less, from similar symptoms since then and complained of great weakness. Swelling of the feet and legs was noted about this time and the swelling has kept on increasing until now. She had taken to bed the day before on account of general debility and the unwieldy size of the feet and legs. She was extremely anæmic, her breathing rapid and shallow, pulse rapid and rather bounding. There was a soft blowing murmur accompanying the first sound and the cardiac impulse was diffuse; cardiac dullness considerably increased. The abdomen was occupied by a spherical smooth tumor, reaching to the upper border of the umbilicus. On bimanual examination, the cervix was found soft and moderately patulous and passed into the abdominal tumor. The breast nipples were surrounded by a dark areola but no colostrum was found. The urine contained a large quantity of albumin and numerous granular and hyaline casts. The diagnosis was made of a probable pregnancy of an abnormal type, or a fibroid growth undergoing sarcomatous degeneration. The advice was given to have the patient enter Mt. Sinai Hospital, and under anæsthesia to explore the uterine cavity. This was done on January 9, and although only a few days elapsed since I had examined the patient, the uterine tumor had markedly increased in size, so that now it reached midway between the umbilicus and the ensiform cartilage. As soon as I could introduce the index finger into the uterine cavity, after dilating the cervix, and it encountered a soft, mushy material, I recognized I had to deal with a hydatidform degeneration of the chorion. I rapidly emptied the uterus of its contents, making certain that all the hydatid material was removed. The patient made a surprisingly good recovery. Her cardiac and pulmonary symptoms disappeared within a few days. The albumin in the urine rapidly disappeared and the casts gradually grew less.

There was a slight bloody flow for four or five days, then a mucopurulent flow for four or five days longer, and after that there was no discharge of any kind. The patient returned home and was gradually gaining in weight and improving in color, when on February 1 she was suddenly seized with a profuse uterine hæmorrhage. I advised the attending physician to pack the vagina and to make immediate arrangements for the patient to be readmitted to the hospital. I saw her two days later. She was considerably exsanguinated. In replacing the vaginal gauze there was a very severe hæmorrhage. I rapidly stuffed some gauze into the uterine cavity and repacked the vagina tightly. From the clinical history and on finding an enlarged, hard uterus with closed cervix, I diagnosed chorio-epithelioma malignum. On the day following, February 4, I performed an abdominal panhysterectomy, not deeming it

[1] Erck and Outerbridge. Internat. Clinics, 1915, vol. 1.

[2] Am. J. Obst., N. Y., lv, No. 6.

safe to wait to curette and submit the scrapings to a microscopic examination. She made an uneventful recovery from the operation. Patient well up to the present.

Pathological report by Herbert L. Celler, Assistant Pathologist, Mt. Sinai Hospital. (Specimen consists of uterus and adnexa.) The uterus is very pale. Length of body 2.5 centimeters, width just below fundus 11 centimeters, length of cervix 4 centimeters. The organ is very firm, the serosa smooth. There is a slight lateral laceration on the right side of the posterior lip of the cervix. The walls of the fundus measure 3 centimeters in thickness at the widest part. The muscular tissue is intersected by numerous bands of connective tissue that coalesce near the mucus to form a more continuous broad band. The mucus lining both the body and cervix is smooth, except at the internal os where there is a slight swelling and congestion, and at the point of entrance of the fallopian tube. At the latter site there is a bean-shaped mass 1.5 centimeters in length, projecting into the lumen of the organ. This tumor is mottled in color, red and white, soft and friable. The underlying muscular tissue is softer than that of the remainder of the uterus, and is also friable. The hæmorrhagic areas are, however, confined to the tumor itself, and are not found in the underlying muscular tissue. The right ovary is normal in size. The left ovary contains two large cysts, one about 1.5, the other about 2 centimeters in diameter. Both fallopian tubes are negative.

Microscopically, the tumor consists of both syncitial masses and Langhans cells. The former are arranged in plaques and in bands, in some places forming a fine meshed reticulum. The spaces thus formed are frequently filled with red blood corpuscles, or contain one or more cells of the syncitial or Langhans type. The former are irregularly shaped, deeply staining, the outlines of the cell not always clearly defined. The nuclei are also irregular, and stain with great intensity. Frequently these cells contain two, three, or four nuclei. The Langhans cells stain faintly, and have a sharply defined outline. The nuclei are round or oval, and vesicular. The greater part of the tumor is composed of the above syncitial masses, but at one point there is a large mass of Langhans cells. Large hæmorrhages are scattered throughout the tumor. At some points the syncitial cells lie close to the walls of blood-vessels or lymph spaces, an occasional cell being present within the lumen itself. The tumor infiltrates the musculature of the uterus for about one-third of its thickness. Scattered between the syncitial masses are numerous leucocytes, while surrounding the entire area of tumor tissue there is a marked round-celled infiltration. Between the tumor and the lumen of the uterus there is a thin band of necrotic tissue enclosing leucocytes and the remains of a few uterine glands. The walls of the blood-vessels of the uterus have undergone hyaline degeneration.

Both ovaries show a number of corpora lutea in which the lutein cells are proliferated. These bodies are small with the exception of one that lies in the midst of the dense tissue of the atrophic ovary. Here there is very marked proliferation of the lutein cells, many of which contain large granules of yellowish pigment. At the periphery of the corpus there are rather numerous distended blood-vessels with thin walls. There are no evidences of organization present.

Diagnosis kindly verified by Dr. F. S. Mandelbaum, Pathologist.

CASE 2.[1] G. H. admitted from the dispensary service into Mt. Sinai Hospital. She was 47 years of age, married 28 years, had nine children, last child eight years ago, two miscarriages, last one nine years ago. Menses had always been regular, moderate in amount, lasting from three to five days, and not attended with pain. Seven days before her admission into the hospital she began to bleed. She was then two weeks overdue. The bleeding persisted and at times was quite profuse. She looked rather old for the age given and was moderately anæmic. Her general condition, otherwise, was good. On bimanual examination, the uterus was found reaching to within two fingerbreadths of the umbilicus and was rather hard to the touch. There was a bluish discoloration of the vagina, and milk could be expressed from the nipples. Dr. F. Krug confirmed the diagnosis of hydatid mole, which was made in my service in the dispensary. He curetted the patient himself, removing a large quantity of hydatid material. The patient made a good recovery and was discharged March 3, with the instruction to return if uterine bleeding recurred. At the time of her discharge the uterus was nearly normal in size. On March 28, she returned to the hospital with the statement that soon after she left the hospital the bleeding recurred, and it has gradually been growing more profuse. The uterus was now found to be considerably enlarged, corresponding in size to the gravid organ at about the sixth week. A diagnosis of chorio-epithelioma was made and on March 30 the uterus removed by me, *per vaginam*.

April 8. The patient made an uneventful recovery and is sitting up out of bed. She was well two years later, when last heard from.

Report on specimen by Dr. F. S. Mandlebaum, Pathologist to Mt. Sinai Hospital. The specimen consists of uterus and adnexa. The uterus is enlarged, 11 x 9. 5 x 5 centimeters. The wall measures 17–30 millimeters in thickness. Occupying the posterior wall and extending downward from the fundus for a distance of 48 millimeters, there is a growth which fills up and slightly distends the uterine cavity. On either side the growth extends to the openings of the fallopian tubes, elevating the mucous membrane and causing it to slope downward to the opening. The tumor is sessile. Its edges are overhanging, except at the upper half. The surface of the tumor is irregular and ulcerated,

[1] Am. J. Obst., N. Y., lv, No. 6.

and microscopic section shows it to be chorio-epithelioma malignum.

CASE 3. Mrs. C. G. admitted to Mt. Sinai Hospital, May 1, 1912. She was 36 years old; married 17 years; VI-para, last child 4½ years ago; no miscarriages except this present one; menses established at 14 years, four-weekly type, duration 2 days. Her last menses occurred 14 weeks ago. Two weeks ago uterine bleeding set in which has persisted up to the present; uterus the size of the gravid organ at 12 weeks.

May 2. Uterus emptied by Dr. F. Krug. The cervix was patulous, admitting the insertion of the index finger with which the membranes were ruptured. A small fœtus and placenta were secured with placental forceps, and the uterine mucosa thoroughly curetted with the sharp curette.

May 14. Discharged from the hospital. The following note was made at this time: Uterus moderately enlarged and lying in retroversion.

June 5. The patient was readmitted, stating that for 2 weeks she felt well and then began to bleed very profusely, which was 10 days ago. The bleeding has persisted until now. The patient is quite anæmic. Local findings about the same as when discharged 3 weeks ago The uterine bleeding is very profuse, necessitating packing of the vagina.

In view of the history and the certainty that none of the ovular products were left behind by Dr. Krug, a diagnosis of chorio-epithelioma was made.

June 6. Abdominal panhysterectomy was performed by the writer. The patient made an uneventful recovery. A year later was in good health.

Macroscopic report, June 6, 1912. The specimen consists of the uterus, the left adnexa complete; and the right tube. The right tube in its distal half is thickened and tortuous; its abdominal ostium is closed by adhesions. The left tube in its distal half is also thickened and tortuous, not quite so much so as that of the other side. The abdominal ostium is patent. The left ovary is somewhat enlarged; studded with small cysts up to size of a pea. The uterus is slightly enlarged. In the left cornu is a small lobulated, firm tumor fixed to the uterine wall and invading it for a short distance. The mass measures 2 x 4 centimeters and is grayish in color. The rest of the uterus and cervix is apparently normal. *Microscopic diagnosis*. Chorio-epithelioma.

CASE 4. Hydatid mole. Chorio-epithelioma. Double ovarian cysts. Hysterectomy. Postpartum eclampsia. Recovery.

Mrs. S. C. was referred to me by her physician, Dr. J. S. Diamond. She was eighteen years old, married fifteen months. Menses at fourteen years, four-weekly type. Duration three to four days. Amount moderate, not with any great pain.

Six months after marriage went two weeks overdue and then began to bleed. Was supposed to have a miscarriage and was curetted Her menses were regular after this for four months and then ceased for two months, when she began to bleed irregularly; at first scantily and later rather profusely. When she consulted me the bleeding had been going on for about two months.

She was very pale, sallow, and looked very ill. The uterus reached up to the umbilicus and was rather tense. The cervix was closed. Behind the uterus lay two irregularly shaped cystic masses each about the size of a closed fist. The urine contained a large amount of albumin and numerous hyaline and granular casts. There was no œdema. The diagnosis was made of an abnormal pregnancy with double ovarian cysts.

Operation, November 22. Finding, on attempting to empty the uterus, that it contained a hydatid mole and as both ovaries were cystic, I decided to perform a panhysterectomy, which I did, removing the cervix also. The operation offered no unusual difficulties and consumed about an hour. The patient withstood it very well. At 5 o'clock the next morning, twelve hours after the operation, the patient was seized with a severe convulsion, lasting about ten minutes. This was followed by coma of twenty minutes. From this hour until 11 a.m. she had, in all, seven convulsions, each followed by coma of longer or shorter duration. The urine was very scanty, loaded with albumin and showed very numerous granular and hyaline casts. Temperature had risen to 104° and pulse 180, very small and soft.

The patient was subjected to the usual treatment for eclampsia; in addition, phlebotomy was done, about sixteen ounces of blood withdrawn, and colon irrigations with saline sclution were given. She showed signs of improvement toward the evening of the same day when the temperature fell to normal although the pulse still remained very high (140 to 160). From this on improvement was steady and on November 30, eight days after the operation, the urine showed merely a trace of albumin.

The removed uterus on microscopic examination showed quite an area of chorio-epithelioma on the posterior wall near the fundus. The ovaries were cystic throughout and showed little or no stroma. There was no excess of lutein cells. December 12. Patient discharged from the hospital as cured.

January 15, 1911. She was again referred to me by her physician on account of bleeding from the vagina. I found a small vascular growth in the center of the vaginal scar and dotted over the posterior wall of the vagina were small flat papules about the size of a split pea and of a bluish-red color. I suspected a recurrence and had her readmitted to the hospital. On January 19, I excised the growth with the Pacquelin cautery and also cauterized the papules on the vaginal wall. The removed growth showed no evidence of chorio-epithelioma, consisting only of connective tissue with blood cells. Patient left the hospital January 25.

May 8. Patient called at my request. She was in good health, her color had become good, she gained in weight. There had been no recurrence of the bleeding. The vaginal wound was healed and the entire vault was smooth and normal in appearance. Two years later when last heard from was well.

Macroscopical report, November 22, 1910. The specimen consists of uterus measuring 13 centimeters from internal os to fundus. The wall measures 2.5 centimeters in thickness. The uterine mucosa is covered throughout by necrotic, velvety tissue which is thrown up in places into markedly rugous and almost papillomatous masses. On section, sinuses of uterus are markedly enlarged. the cross section of the muscularis having a fenestrated appearance. Both ovaries are enlarged into irregular ovoid, orange-sized, completely cystic masses with straw-colored, mucin-like contents, some of them containing blood.

Microscopical diagnosis. (a) Chorio-epithelioma. (b) Polycystic degeneration of both ovaries. No marked proliferation of lutein cells. (c) Hydatidiform mole.

CASE 5. Chorio-epithelioma. Abdominal panhysterectomy. Recovery.

Mrs. C. B. was admitted to Mount Sinai Hospital on March 17, 1911. She was 36 years old, married at 18 years, 7 children, the youngest child being 23 months old. Menses at 14 years of age, irregular, three to four-week period up to two years ago; since then, menorrhagia of 2 to 10 weeks at a time. The last regular period was 12 weeks ago; bleeding since. For past 2 years she has had slight pain in the lower abdomen, associated with backache and slight leucorrhœa.

Vaginal examination showed the uterus to be uniformly enlarged to size of 10 weeks' pregnancy; fairly soft; the adnexa normal; and the presence of a good-sized rectocele and cystocele.

March 21. The patient had a rather profuse hæmorrhage from the uterus. She became pulseless and required very active stimulation. Hæmoglobin 64 per cent. Panhysterectomy by Dr. Krug.

The specimen consists of a fibroid uterus about the size of a 3 months' pregnancy. In the cavity there was a shaggy mass attached by a pedicle to the fundus, resembling very much a piece of placenta, which might be a necrotic submucous fibroid.

April 17. Patient was discharged in good condition.

Macroscopical report, March 21, 1911. The specimen consists of the uterus which is enlarged. The uterus shows marked hypertrophy of the wall which measures 3 centimeters. Near the fundus on the anterior wall is an area, covered by soft granular and fungoid tissue which causes a thickening of from 1 to 4 millimeters in the endometrium. Besides this is tissue which appears to be amnion and chorion.

Microscopical diagnosis. Chorio-epithelioma.

CASE 6. A. H. was admitted to the Mount Sinai Hospital on June 12, 1911. She was 33 years old, married 12 years, five children, last child 21 months ago, doubtful miscarriage 3 months ago. Menses at 14 years, four-weekly type, duration 7 days. Three months before, when menses were due, she merely stained. A month later stained again. At the recurrence of the next menses, she flowed very profusely and suffered with pain in the right iliac region. She was then admitted to the Lying-In Hospital. where she was curetted for a miscarriage. The flow persisted after the curettage and so did the pain. On admission the patient was found to be moderately anæmic. The uterus was about of normal size and the adnexa were apparently normal.

In view of the history of the case, chorio-epithelioma was suspected. Not desiring to subject the patient to another curettage, it was decided to explore the uterus visually by an anterior colpotomy, and if necessary by an anterior hysterotomy.

Operation, June 15. A transverse incision was made in the anterior vaginal fornix; and the uterus delivered through it. In the right cornu was seen a small vascular tumor the size of a filbert, and presenting the characteristic bluish discoloration of a chorio-epitheliomatous growth. The operation was completed by extirpating the uterus and adnexa through the vagina. The patient made a rapid recovery and was discharged on July 1. She was under observation for two years and remained perfectly well.

Macroscopical report, June 15, 1911. The specimen consists of the uterus with both tubes and ovaries. The uterus measures 7.5 x 5 x 3 centimeters. It is the normal multiparous shape. The cervix shows a shallow old laceration to the right. The wall of the uterus is 1.5 to 2.2 centimeters in thickness. A papilliferous mass is situated at the fundus in the neighborhood of the right horn. Its base is 1.7 centimeters wide and 2.2 centimeters long (from above downward), and the mass projects about 5 centimeters beyond the surface of the mucosa. The tumor is fairly firm and is pinkish brown in color. Both ovaries are of about normal size and cystic (old corpus luteum cysts.) No recent corpus luteum of any prominence is visible.

Microscopical diagnosis. Chorio-epithelioma.

CASE 7. Chorio-epithelioma. Septicæmia-streptococcæmia. Hysterectomy. Death. Mrs. L. L., 31 years of age, married 5 years, had 2 children, one three and a half years ago and the second four months ago. She was seen in consultation by me March 18, 1910, for persistent uterine bleeding. Her medical attendant, an intelligent practitioner, informed me that he had delivered the patient at term with instruments four months before. The patient went through a normal puerperium, but the flow of blood in small quantities persisted for three weeks. It then ceased for three weeks when it recurred and continued off and on in slight amounts, until two weeks before, when rather a sharp hæmorrhage took place. He then curetted her, removing apparently several fragments of placental tissue. This put a stop to the bleeding for some days when it recurred again slightly with rather a free flow now and then. On the night previous she had a profuse flow of blood. I found a strong, healthy looking woman inclined to obesity, with moderate pallor of the lips. She was nursing, and the infant seemed to be thriving satisfactorily. On bimanual examination I found the uterus enlarged to the size of the gravid organ at about six weeks. The cervix

was patulous, admitting the index finger readily, which on exploring the uterine cavity detected a sessile growth on the anterior surface of the uterus, near the left horn, corresponding in size to about a fifty-cent silver coin, raised above the surface about one-fourth of an inch, and presenting on its surface a shallow depression. There was no marked hardness of the growth. I made the diagnosis of a probable chorio-epithelioma, and stated that I would be more certain of the diagnosis had not a curettage been done a short time before. I argued that a placental residue, the other alternative in diagnosis, would not present a crater-like excavation on its surface. But here entered the element of doubt. Could not the excavation have been produced artificially by the curette? I advised, therefore, her entrance into Mount Sinai Hospital where the growth could be removed with the curette and subjected to microscopic examination. I curetted her that afternoon in the hospital without anæsthesia in the presence of Dr. F. S. Mandlebaum, the pathologist of the hospital. The curette removed so much tissue that looked like ordinary placental tissue that both he and I thought that it was an ordinary case of bleeding from placental remains. The temperature, rectal, before curettage was 100.8°, pulse 108. March 19, temperature, 99 to 100.4°, pulse, 100 to 108. March 20, temperature, 99.6 to 100°, pulse, 96 to 100, no bleeding.

Report from the pathologist stated that removed tissue showed nothing more than normal decidual structures. Being anxious to have the patient return to her nursing infant as soon as possible I had given orders to have her transported home in the ambulance. On the following morning, March 21, just as the patient was being gotten ready to be sent home, she had a moderate flow of blood. She was taken into the examining room and the interior of the uterus gone over lightly with a curette on the supposition that a small fragment of tissue might have been left behind. The curette did not bring away enough tissue to account for the bleeding. She had scarcely been returned to her bed when she had a severe hæmorrhage and she was at once brought back to the examining room and the uterus packed tightly with iodoform gauze. I now felt that we had, in all probability to do with a malignant growth, notwithstanding the report from the laboratory, and requested that a further examination be made of the tissue removed that morning. Four p.m., temperature, 102°, pulse, 136. Assuming that the fever was due to the uterine packing, the house surgeon removed two pieces of gauze from the vagina, under the belief that on so doing he had removed all the gauze that had been employed in packing. March 22, 4 and 8 a.m., temperature, 99.4°, pulse 116. Four p.m., temperature suddenly rose to 104°, pulse, 120; 8 p.m., temperature, 105.6°, pulse, 134. I had seen the patient in the morning when her temperature was normal and concluded that the temperature of the evening before was due to retention due to the uterine packing which was relieved by removal of the gauze. In the evening her condition was reported to me and I immediately visited the patient. On specular examination, I found that the house surgeon had removed only the vaginal packing and that the uterine gauze was still *in situ*. I removed it and irrigated the uterus with alcohol 50 per cent. March 23, 8 a.m., temperature, 105.6°, pulse, 140; vomited once. Blood culture taken. Decided to remove the uterus as soon as consent could be obtained. Eight p.m., temperature 103.8°, pulse, 148. Hysterectomy. Owing to the patient taking the anæsthesia poorly and to the great abundance of fat in the abdominal wall and in the subperitoneal tissue of the pelvis, it was not feasible to carry out ligation of the pelvic veins. Patient withstood the operation very well. March 24, 8 a.m., twelve hours after operation, temperature, 103.2°, pulse, 140.

March 24, 4 p.m., chill, temperature, 106.4°, pulse, 140 to 180. March 25, 4 a.m., patient died.

Notes from the pathological laboratory. March 18, 1910. Specimen of retained placenta received. Decidua with markedly atypical cells, some very large with giant nuclei. Diagnosis is in doubt, but it is suspicious of malignant change.

March 23, 1910. Uterus received for examination. Organ is moderately enlarged, and musculature is soft and flabby. Uterus measures 9 centimeters; wall considerably thickened, 18 x 25 millimeters. Mucosa shows evidence of curettement. In the body anteriorly is a lenticular avid tumor occupying the site of the mucosa, and the tissues immediately underneath infiltrate the muscularis for about 1 to 2 centimeters. On section this area measures 3½ x 2 centimeters and is composed of soft, hæmorrhagic, necrotic tissue. The microscopic sections of the uterine tumor show the so-called atypical variety (Marchand) of chorion epithelioma. In the superficial zone there is extensive necrosis, hæmorrhage, and conglomerate masses composed of atypical, acidophile syncytium and cells of the Langhans type; in the deeper layers, syncytial masses and chorionic wandering cells of bizarre shape penetrate the muscle for a considerable distance and are also found free in the blood sinuses. Diagnosis: chorion epithelioma.

Autopsy performed on March 25, 1910, at 2 p.m., by Dr. A. E. Cohn. Case of chorio-epithelioma with pulmonary metastases. Body of an adult adipose female. Panniculus adiposus well developed. Operative incision in the median line above the symphysis pubis, about 15 centimeters long.

The lungs are both voluminous, pinkish gray in color. Adhesions between lobes and between lung and pleurae. Scattered through right lung, but more especially projecting along borders, are small tumor masses varying in diameter from 3 to 10 millimeters. On cut section they project sharply above the surface of the lung and are sharply circumscribed, and have a "port wine" and a somewhat reticulated appearance. The reticulum is grayish. The dependent portions of the lung are

congested. There is no consolidation; no tubercles; no metastases. The bronchi are congested; the pulmonary arteries are normal. The left lung shows adhesions similar to the right, except that there is no fibrinous exudate on surface. There are about twelve metastases of the shape and size described.

The heart is normal in size with marked fatty overgrowth. The pericardium is normal. The right auricle is somewhat dilated, but not the right ventricle. There are marked chiari over the coronary sinus, the muscle is flabby and pale. The tricuspid valve admits two fingers, the edges of the valve are retracted, thickened, but show no recent lesion. The aorta shows fairly marked atheroma, the posterior much less than the anterior. Foramen ovale closed.

The liver shows slight parenchymatous and fatty degeneration, otherwise normal.

A slight perisplenitis is present but diffluent. The lymphatic structures of the spleen are not easily made out.

The kidneys show marked parenchymatous degeneration.

Floor of the pelvis is clean. There is some bluish discoloration along the line of suture. The vesical veins show no abnormality. The inferior vena cava in its lower half shows no thrombosis.

Microscopical examination. There are metastases in the lung. The tumor mass itself is composed of large blood sinuses together with necrotic areas into which there has been hæmorrhage. Scattered through the tumor, but especially at the periphery there are groups of cells characterized by irregularity in size and shape. Nuclei for the most part are large and vary in their amount of chromatin; some of them are almost vesicular and others show a dense network. The cell bodies, where they can be observed, are irregular in shape and finely granular. A number of cells show karyorrhexis. These cells are for the most part isolated, having only a slight tendency to form groups. A number are vacuolated. The diagnosis of chorio-epithelioma is made.

CASE 8. R. W., aged 50. Married 26 years; ten children; last child eight years ago. Three miscarriages, last seven years ago. Patient consulted me May, 1911. She stated that her menses for the past year had been irregular, occurring from four to eight weeks. A month ago, after a period of amenorrhœa of eight weeks she began to bleed. The bleeding persisted with varying intensity up to the time of her seeing me. I found the uterus enlarged, had the sign of a gravid organ of about 12 weeks. It had a soft doughy feel. A diagnosis of hydatid mole was made, and the patient given a card of admission to Har Moriah Hospital.

May 15, 1911, operation. Vaginal hysterectomy. Uterus emptied with the hand of about a quart of characteristic vesicles. Interior of uterus palpated. A suspicious nodule was felt in the posterior wall. Operation completed by doing a vaginal panhysterectomy. Microscopic examination by the pathologist of the hospital confirmed diagnosis of chorio-epithelioma, which was also confirmed by Dr. L. S. Mandlebaum, pathologist to Mt. Sinai Hospital. Patient in good condition up to the present, seven years after the operation.

CASE 9. Mrs. J. S. admitted to the Mount Sinai Hospital on November 3, 1915. She was 44 years old, married for 26 years, had seven children, one dead, youngest child six years old; all pregnancies full-term, and normal delivery; one miscarriage. Menses began at 14 years, regular every month, duration from four to five days. Up to six weeks ago patient had amenorrhœa for past five months. During this time she commenced to bleed, and this has continued steadily and progressively up to the present time, much blood being lost.

Physical examination revealed the following: The abdomen, was soft, relaxed, tympanitic. There was a mass present, reaching almost to the umbilicus, hard and smooth in consistency, conforming to shape of a gravid uterus of four months' advancement. The mucous membrane of the vaginal canal was of a violet hue. The uterus was large, anteflexed conforming to size of pregnant uterus of almost four months. Adnexa were not felt. Cervix not patulous, direction down and forward.

November 5, 1915. Hysterotomy and emptying of uterus for hydatidiform mole performed by Dr. S. Wiener. November 15, 1915. Uterus well involuted. Hysterotomy wound, slight gaping at one point. November 16, 1915. Patient discharged in good condition.

Pathological report, November 10, 1915. Tissue from uterus- hydatid mole.

November 17, 1917. Patient readmitted. Diagnosis chorio-epithelioma. Vaginal flow daily for four months. (Through courtesy of Dr. Joseph Brettauer).

Vaginal examination disclosed a moderate cystorectocele; cervix hard and nodular. Uterus anterior, slightly enlarged. Fundus globular and hard. Both fornices clear. Uterine bleeding. Sound determines small smooth sound nodules on left lateral and anterior walls. Slight tear in perineum. Uterus slightly enlarged.

November 19, 1917. Exploratory curettage by Dr. Lindeman. November 21, 1917. Cervix gauze removed. Patient's condition good. Extra systoles more frequent, otherwise no signs of cardiac lesions.

November 22, 1917. Vaginal hysterectomy for chorio-epithelioma by Dr. Lindeman.

Specimen. Uterus slightly enlarged. Normal tubes and ovary. On opening the uterus there was present in the fundus a small (2 centimeters) friable, pedunculated tumor, dark brown in cross-section and on surface, extending only a short distance into uterine tissue. November 19, 1917. Curettings show evidences of malignant tumor suspicious of chorio-epithelioma. November 22, 1917, uterus and adnexa show chorio-epithelioma.

December 3, 1917. Patient discharged from hospital in good general condition.

A VAGINAL HYSTERECTOMY TECHNIQUE FOR THE CURE OF PROLAPSE OF THE UTERUS WHEN THE REMOVAL OF THE UTERUS IS NECESSITATED

With Special Reference to Lapping of the Vaginal Fascia in All Forms of Vaginal Prolapse[1]

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IN an article read by me before this society at its last meeting describing a subtotal vaginal hysterectomy technique for the cure of procidentia uteri, I reached the conclusions that (1) there was encountered in it an element of danger to life, as the result, probably of necrosis of the reconstructed uterine body, which did not justify its further use; (2) that the interposition of the reconstructed body added nothing to the result when success was obtained; (3) that the essential features in the successes were the approximation of the cut surfaces of the cardinal ligaments and the correct readjustment of the fascial structure of the anterior vaginal wall.

My object in this communication is to make a preliminary report of a vaginal hysterectomy technique for the cure of prolapse of the uterus where the removal of the uterus is necessitated and to advocate the principle of fascial lapping in all forms of vaginal prolapse. The initial steps of the hysterectomy technique will be recognized as identical to those described in my previous study. The method of lapping the fascia described in the following sentence will be recognized as a plan of procedure suggested by me in the article referred to. "Sometimes the anterior vaginal wall, like the uterus, is considerably hypertrophied. When this is the case the mucosa can be removed in part from one lateral strip and the strips lapped so as to give additional strength."

It was not until December 11, 1917, and January 17, 1918, that there came under my care cases which conformed to the above description; namely, great hypertrophy of the uterus and vaginal wall and complete procidentia. A report of these cases and of the operation performed for their relief was made before the New York Obstetrical Society February 12, 1918, and a description of the procedure which was followed will be published in the June issue of the *New York Journal of Obstetrics*.

VAGINAL HYSTERECTOMY AND FASCIAL LAPPING FOR PROCIDENTIA UTERI

Two curved incisions, meeting in front and behind, are made about the cervix at its juncture with the vaginal mucosa. The vaginal tissue is separated from its cervical attachments and each cardinal ligament area of tissue severed from the cervix and penetrated and tied with a chromic gut suture No. 2. As the free ends of these sutures are to be used at the completion of the operation forceps are now attached to each group.

The vesicofascial area may be entered by either a longitudinal incision or by the curved incisions as they pass above and to the sides of the cervix. The preferable approach to this area of cellular tissue is through the curved incisions. When this area or line of cleavage between the bladder and fascia is found it is followed by blunt dissection on each side of the lateral limits of the anterior vaginal wall. The so-called vesico-uterine ligament, which is but a part of the vesicovaginal fascia, is next severed and the bladder separated entirely from its fascial attachment starting below and working upward. As the freeing of the bladder from the fascia is continued toward the urethra the anterior vaginal wall is incised in the median line until the blending of the fascia with the urethral tissue is reached.

The posterior surface of the bladder is now completely separated from the anterior wall of the cervix and the peritoneal reflection incised. The tissues between the cervix and

[1]Read before the American Gynecological Society, Philadelphia, May, 1918.

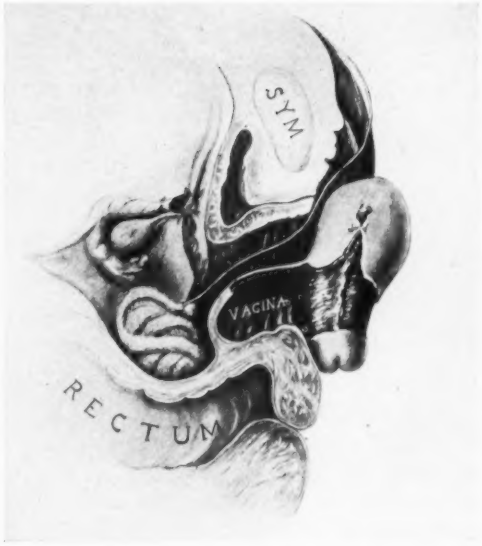

Fig. 1. Showing the uterus out of the vagina with all its attachments severed except the posterior vaginal barrier, which barrier with the gauze strip passed through the anterior opening, prevents the vaginal contents entering the peritoneal cavity.

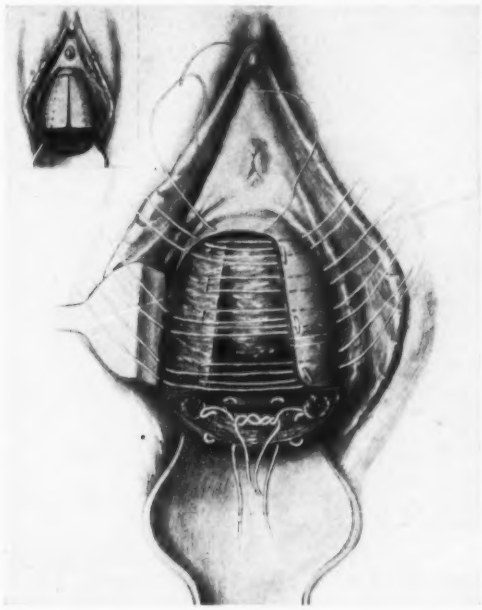

Fig. 2. The marginal insertion in the upper left hand corner shows the initial incision of the anterior vaginal wall and the opening in the vault of the vagina on the removal of the uterus. The dotted lines indicate approximately the amount of tissue removed longitudinally from each flap.

The larger illustration shows the underlapping flap denuded of its mucous membrane and the sutures placed for anchoring both flaps. A bundle of tissue is seen on each side of the vault of the vagina, encircled by a chromic gut suture. One strand of each suture is passed in and out along posterior vaginal cut surface to control hæmorrhage and the other tied with its opposite free strand to approximate the lateral bundles or cardinal ligaments.

the rectum are likewise separated, but the posterior peritoneal reflection is not incised.

The corpus uteri is now delivered through the anterior peritoneal opening and a narrow strip of gauze, to which is attached a piece of catgut, is passed into the peritoneal cavity to protect it and prevent the intestines and omentum from protruding.

The vaginal flaps are next prepared for lapping by first trimming them longitudinally to not less than half their original size. From the right flap, or that to the left of the operator, the mucosa is completely removed. This flap is severed crosswise near its urethral attachment to the extent of about 0.5 centimeter so as to facilitate its adjustment when anchoring it under the opposite flap.

Four or more mattress sutures of chromic gut No. 2 are now inserted in such a manner as will anchor this denuded flap under the undenuded flap and to the opposite stable line where the fascia meets the lateral limit of the vagina. Four or more interrupted chromic gut sutures No. 2 and a continuous suture are used to anchor the undenuded flap to the opposite stable line, or lateral limit of the vagina, and also to approximate the cut edges of the mucosa.

One strand of each chromic gut suture surrounding each so-called cardinal ligament is utilized as a running suture along the posterior cut surface of the vaginal vault to prevent hæmorrhage, which not infrequently occurs from this surface. The remaining strands are now tied to approximate the cut "cardinal ligament" tissues. These latter sutures are used again and made to penetrate the lower margin of the newly constructed anterior vaginal wall from within out and tied to the sutures passed through the poste-

Fig. 3. A sagittal section showing a larger rectocele with cervix in normal position.

rior vaginal wall. Before tying these sets of sutures a narrow strip of iodoform gauze is passed into the posterior vaginal space. Iodoform packing in the vagina completes the operation.[1]

The features which I would particularly emphasize in this technique are (1), the separation of the cellular tissue at the beginning of the operation from the posterior surface of the cervix up to the peritoneal reflection without opening into Douglas' cul-de-sac. The great advantage of not entering the peritoneal cavity at the beginning of the operation is that the continuity of tissue here acts as a barrier to prevent the contents of the vagina from soiling the peritoneal cavity and the intestines from protruding into the vagina; it also prevents the cervix uteri from coming in contact with the peritoneum when the fundus is anteverted and the cervix is forced back into the vagina.

The second feature pertains to the removal of the corpus, which is delivered through the anterior peritoneal opening and operated on at the vulva. Each step in its removal is executed with greater ease and exactness by attacking the upper portion of the broad ligaments first and working downward than by attacking the tissues around the cervix first (corpus remaining in peritoneal cavity) and working upward.

The third feature is the reinforcement of the anterior vaginal wall by lapping the fascia and anchoring the cut margins to the stable areas of the vaginal canal and approximating the cut surfaces of the cardinal ligaments.

That prolapse of the uterus, as well as of the anterior vaginal wall, has been cured by varied surgical procedures is not to be questioned, but failures continue to occur and no method has yet established itself in the confidence of the majority of surgeons.

When success is attained by any of the methods *per vaginam* now in vogue, emphasis is placed upon some particular feature considered essential for success. When hysterectomy is done for the relief of procidentia we find emphasis laid upon the approximation of the cut edges of the round and broad ligaments in one method, the shortening of the uterosacral ligaments or the anchoring of the round ligaments in the vault of the vagina in another, the interposition of the approximated round and broad ligaments or of the resected corpus uteri in still others. In my opinion all these special features are given undue consideration, and success, when attained, is the result not of them but of a common element entering into all of them—namely, surgical adjustment of the pelvic fascia.

It is not my object to discuss the individual operations for the cure of procidentia uteri and cystocele, but it would seem fitting, because of its historic interest and the principle involved in the Emmet operation to do more than make passing mention of it.

Emmet utilized the principle of fascial support of the anterior and lateral vaginal walls with the intuition and skill of the consummate surgeon he was. He recognized that success depended "upon the unyielding line along the vaginal sulcus on each side where the walls are connected with the pelvic fascia"—and that this tissue, owing to its elasticity, can be stretched to a certain degree

[1] Previous to operation a 10 per cent nitrate of silver solution is applied to the vaginal mucosa and the external os closed with a continuous catgut suture.

but for all practical purposes the areas are fixed.[1] By Emmet's method two lateral fascial surfaces are united to a central fascial surface; in this way the fascial support of the uterus and bladder is reconstructed and we have here the first instance, on a limited scale, of fascial lapping of the anterior vaginal wall. In Emmet's hands success by this method was the rule. In the hands of others success seems to have been the exception. I would not refer to this operation, long since considered obsolete by many, were I not convinced that it possesses an essential feature of success. Grant Baldwin recognized this fact several years ago, and also the cause of failure in the original technique and modified it with such results as should demand our respectful consideration.

It would seem a justifiable conclusion, with the evidence at hand, that the underlying principle of success in operations for the cure of uterine and vaginal prolapse is the proper surgical adjustment of the pelvic fascia; but the fact remains that we have not yet developed a standard technique or one which can be applied, with such modifications as the necessity of the individual case demands, to meet all requirements.

When a prolapsed uterus has undergone such structural change as necessitates its removal, or when, after menopause, its removal is considered for one reason or another desirable, the vaginal hysterectomy technique as herein described, will prove, I believe, the method most adaptable and satisfactory. I recognize that it has not yet been put to the test of time, but as it is in principle identical to that upon which nature, under normal conditions, depends for support, confidence in its ultimate success would seem justified.

CERVIX AMPUTATED, CORPUS RETAINED, AND FASCIA LAPPED

When it is found advisable, in cases of procidentia uteri, to retain the uterine body but amputate the cervix, the following technique presents certain advantages:

The first stages of the technique are in part identical to the first stages of the vaginal hysterectomy technique previously described, that is the vesicofascial area near the cervix may be entered by either the longitudinal or curved incisions. The line of cleavage is then followed laterally to the side walls of the vagina, longitudinally to the urethral region and along the cervix to the peritoneal area. As the separation of the bladder from the fascia progresses the anterior vaginal wall is incised in the median line up to the urethral region. The vaginal wall flaps are now trimmed longitudinally to the extent required and the flap to the left of the operator denuded of its mucous membrane. The sutures anchoring the flaps are placed in the manner described in the vaginal hysterectomy technique for

[1] Emmet. Principles and Practice of Gynecology, p. 257.

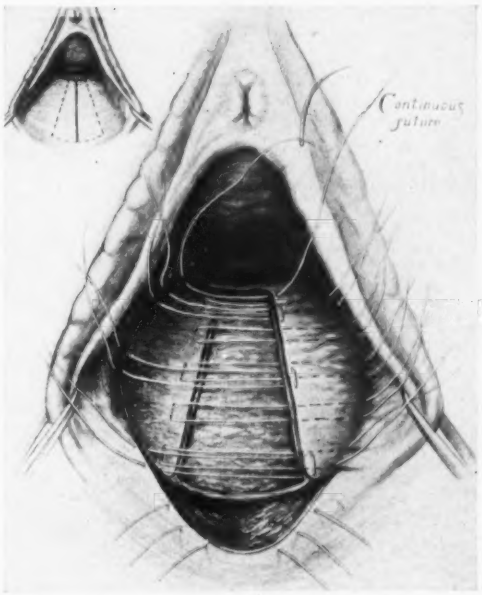

Fig. 4. The dotted lines on the marginal insert indicate the approximate amount of tissue removed longitudinally from each posterior vaginal wall flap. The drawing is somewhat misleading as the amount of tissue removed is really more than would seem from the drawing. The tendency is to undercorrect by not removing enough tissue. The appearance after operation should be that of overcorrection.

The larger illustration shows the underlapping flap denuded of its mucous membrane; the line of fascia merging with the perineal body; the denuded perineal body and all sutures placed for anchoring flaps and closing perineum.

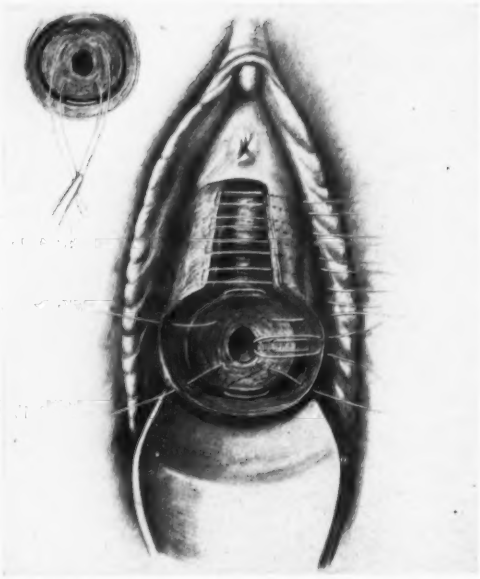

Fig. 5. This illustration shows the several stages of the operation for prolapse of the uterus where the corpus uteri is not removed, but where the cervix is amputated. The steps in the operation with respect to the anterior vaginal wall are practically identical to those where the corpus is removed. Immediately after amputating the cervix, two chromic gut sutures No. 2 are inserted in the cervical stump according to the manner shown in the insert. These sutures serve as tractors and control hæmorrhage during the progress of the operation. After anchoring the vaginal flaps the free ends of these sutures are passed through the vaginal tissues on each side and when tied anchor this vaginal tissue over the cervical stump. The middle suture in the main illustration is devised first to shift the position of the lateral tissue or cardinal ligament, and second to anchor the vaginal mucosa to the cervical stump. The method is reversed to that of Emmet and tends to lengthen rather than shorten the anterior vaginal wall.

procidentia uteri, namely, four or more mattress sutures being used to anchor the denuded or underlapping flap to the opposite stable line of the lateral wall of the vagina and four or more interrupted chromic gut sutures and a continuous suture to anchor the undenuded or overlapping flap to the opposite stable line of the lateral wall of the vagina.

Previous to tying the sutures of the anterior vaginal wall the mucosa about the cervix is stripped back laterally and posteriorly sufficiently to permit of a high amputation of the cervix. The sutures of the cervix are placed according to a plan which is here particularly adaptable and serviceable. One figure-of-8 suture is inserted through the upper area of the cut surface of the cervical stump and one through the lower area. These two sutures may be placed immediately after the amputation of the cervix and used as tractors controlling hæmorrhage at the same time. At the completion of the operation their free ends are passed through the edges of the freed vaginal mucosa and when tied they approximate the mucosa over the stump. The sutures which direct and secure the vaginal mucosa to the cervical canal are inserted in an opposite direction to the classical method of Emmet. The needle is first inserted into the more or less free lateral tissue or cardinal ligaments on each side. The free ends of each of these sutures are passed through the cervical stump near the canal and back through the margin of the freed vaginal mucosa of the same side. By this form of stitching two objects are attained, namely: the cardinal ligaments are anchored to the cut surface of the cervical stump and the vaginal mucosa is anchored to the cervical canal. Extra sutures may be inserted, if necessary, and finally a narrow strip of iodoform gauze is passed through the cervical canal into the cavity of the uterus to prevent a possible union of the cut edges of the mucosa in the region of the cervical canal. Perineorrhaphy is done, if required, and the vaginal canal is packed moderately tight with iodoform gauze. By the Emmet technique the tissues of the vesical area are used to cover the anterior surface of the cervical stump, and to that extent the anterior wall is shortened. If his method is reversed according to the plan just described the length of the anterior wall is not shortened.

When in the childbearing period prolapse of the uterus and bladder is corrected by fascial lapping and the uterus retained it is as yet an open question whether or not the reconstructed fascial wall would prevent or in any way interfere with the process of labor. I have not as yet operated for procidentia uteri or cystocele by the fascial lapping method and preserved the entire uterus.

Fig. 6. This illustration shows a partial rectocele with deep vaginal sulci and a complete laceration of the sphincter. The black line indicates the first incision made in performing the Ristine operation. The repair of the sphincter and correction of the rectocele were done at the same time.

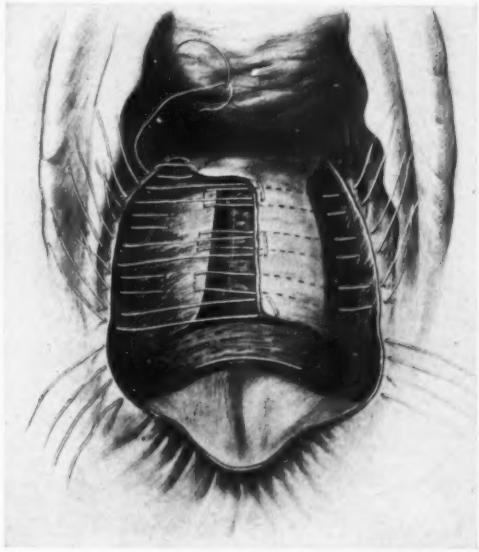

Fig. 7. In this instance we had two deep sulci to care for. The posterior vaginal flaps were prepared in the way previously described, except that the flap to the right of the operator was not trimmed longitudinally, and that portion of it which extended down in the sulci was denuded of its mucosa as was its corresponding lateral vaginal wall. The sutures were then placed in the manner shown in the drawings. When these sutures were tied, the flaps were anchored in such a way as to obliterate the sulci and elevate the posterior vaginal wall.

The Emmet-Baldwin operation does not permit of the completion of labor without the destruction of the operative results.

With complete procidentia uteri both the anterior and posterior vaginal walls prolapse in greater part; while this is the rule, cases do occur where one wall protrudes from the vulva more than the other, so that in one case we may have a marked cystocele, with the posterior wall but little affected, and in the other case a marked rectocele with but little protrusion of the anterior wall. Protrusion of one or another vaginal wall accompanying procidentia uteri does not, however, necessarily constitute rectocele or cystocele, but such a situation indicates a more or less damaged structural condition of the walls and demands surgical repair.

True cystocele is a more common accompaniment of procidentia uteri than rectocele. Either may exist independent of procidentia, but if associated with procidentia they precede and do not follow. A cystocele therefore may exist with the cervix in normal position, likewise a rectocele may exist with the cervix in normal position. The case of Mrs. D., which I reported in my last communication on this subject, was a striking example of the first type, and the first case of rectocele to be here reported, a description of which constitutes the basis of my work on fascial lapping for the cure of rectocele, is an example of the second type.

FASCIAL LAPPING FOR RECTOCELE

The mucous membrane of the perineum is first removed and the rectovaginal fascia exposed. This fascia is incised at about where it merges with the perineum or its remaining structures. On incising the fascia a cellular area is entered, which area constitutes the line of demarcation between the rectum and the vagina. The cellular tissue encountered is now separated from the under

surface of the fascia, laterally to the borders of the levator ani and longitudinally to the region of the cervix. As the freeing of the tissue from the fascia is continued in the direction of the cervix a median longitudinal incision is made and extended as far as necessary.

The vaginal flaps are now prepared for lapping by first trimming them longitudinally to an apparently excessive degree. The extent of this trimming depends on the amount of redundant tissue or size of rectocele. Roughly speaking only about half of each flap remains and the effect produced after completing the operation is that of overcorrection.

The flap to the left of the operator is now carefully denuded of its mucous membrane. Scissors are used to make the denudation, as by careful use of them a thin submucous layer of tissue is left upon the fascia, which serves to maintain the fascial continuity of the flap. The flap thus remaining is relatively thick and resists the strain of the sutures better than the fascia alone would do.

The denuded flap is now severed crosswise at its highest point to the extent of about 1 centimeter in order to make a better fascial approximation when the flaps are lapped.

Four or more mattress sutures of chromic gut No. 2 are now used to anchor the denuded or underlapping flap to the opposite unyielding line where the fascia meets the lateral limits of the vagina. Four or more interrupted chromic gut sutures and a continuous suture are used to anchor the undenuded or overlapping flap to the opposite unyielding line along the side wall of the vagina.

When the rectovaginal flaps are anchored the perineal sutures are tied.

With rectocele, as with cystocele, we have a damaged condition in part or in whole of the fascial support. When this damage is not extensive and is limited to the perineal area, surgical approximation of the perineal portions of the levator ani muscles constitutes a sufficient barrier, but when an extensive rectocele exists, such as involves the entire posterior wall, or when the fascia has been torn away from each lateral wall, as in the second case to be cited, fascial lapping to the extent of the rectocele can alone be depended upon.

A rectocele may have associated with it taxing complications and the operative technique used must be modified accordingly as illustrated in the following case: Laceration of the perineal body through the sphincter ani, extensive lateral tears of the posterior vaginal wall, forming a sulcus on each side 4 centimeters or more in length and 2 centimeters in depth. The rectovaginal fascia was here torn away from the lateral walls and the posterior or rectovaginal wall bulged out like a tumor protruding from the vulva.

A crescentic incision was first made over the torn perineal area according to Ristine and the flap of tissue dissected down to the rectum and the skin border. The protruding pouch was next incised immediately above the crescentic incision and the rectovaginal cellular area entered. The line of cleavage from this point was followed laterally to the side walls and longitudinally beyond the limits of the pouch. A longitudinal incision was now made in the middle of the posterior wall, extending half its length. The flaps were trimmed longitudinally and the mucosa was completely removed from the sulcus and the flap to the left of the operator. The mucosa of the sulcus to the right of the operator was also removed, but the mucosa of the vaginal flap from this side was not removed. Several mattress sutures were inserted which when tied approximated the denuded surfaces of the sulcus to the right and anchored the denuded flap to the stable line, where the fascia normally meets the lateral limits of the vagina. The free margin of the undenuded flap was anchored to the opposite stable line along the side wall of the vagina. The mucous membrane edges were united, with a continuous catgut suture. Two plain catgut sutures No. O penetrated each free end of the sphincter ani muscle to approximate and accurately adjust these separated ends. Silver wire sutures were placed in the perineum in the usual manner, one penetrating the free ends of the muscle. The results of this operation were not only a complete restoration of the sphincter and the perineal body, but a correction of the

rectocele and an elevation of the entire posterior vaginal wall to practically its normal position. Hysterectomy had previously been performed for procidentia according to the method herein described, a report of which operation will be found in the *New York Journal of Obstetrics*, June, 1917.

It was found necessary in the first case of rectocele here reported to keep a depressor in the space created by the separation of the rectum from the vagina in order to prevent the fat deposited in the cellular tissue from interfering with the proper adjustment and anchorage of the denuded flap when the sutures were tied.

Fascial lapping meets its ideal application in extensive rectocele and cystocele. When applying this principle to these conditions the several fascial areas which have been given special names have as such no particular value. When cystocele is present a greater portion of the bladder is enveloped by the overstretched anterior vaginal fascia than normally exists. The same is true of the rectum when rectocele exists and the surgical problem here presented is to restore the normal relationship of the viscera and fascia, and reinforce the supporting structure so as to form an effective barrier and support.

The most satisfactory approach to the line of cleavage between the bladder and the fascia is at the angle formed by the cervix and the anterior vaginal wall. As the incisions sweep around the cervix from above, they should be made to cut through both the mucosa and the fascia. The line of cleavage entered here is followed laterally to the limit of the vagina and then longitudinally to the region of the urethra. The longitudinal incision of the anterior wall is started in the median line below and continued upward as the bladder is separated from the under surface of the fascia.

When the vesicofascial line of cleavage is sought entirely through a longitudinal incision of the anterior vaginal wall it not infrequently happens that the line of cleavage between the mucosa and the fascia is mistaken for the line of cleavage between the fascia and the bladder, and as a result, the fascia is considerably injured in the effort to define and free the bladder. One of the great advantages of the fascial lapping technique here described, whether dealing with a cystocele or rectocele, is that the finding and following of only one line of fascial cleavage is necessary. When this line of cleavage only is followed a minimum amount of bleeding results, but when both lines of fascial cleavage are followed a maximum amount of bleeding occurs, which under certain conditions may terminate seriously. Another important advantage in thus utilizing the fascia, without disturbing its continuity, is that a minimum amount of disturbance in its circulation is occasioned, and when the flaps are anchored the circulation in them remains practically unimpaired.

Too much emphasis cannot be laid on the desirability of trimming the vaginal flaps to apparently an excessive degree. Failure will occur if the effect produced after the completion of the operation is not that of overcorrection.

THE EFFECT OF HYSTERECTOMY UPON OVARIAN FUNCTION[1]

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THE purpose of this communication is to present an analysis and impartial estimate of the existing evidence for and against retention of ovarian tissue after hysterectomy. Such a study seems both timely and desirable for two reasons: (1) because our knowledge of ovarian function has been substantially increased during recent years, chiefly through the intensive study of endocrinology, and (2) because there has arisen a sharp division of opinion among those most competent to decide this matter. One group is persistently advocating the routine conservation of healthy ovaries after hysterectomy, while a minority is vigorously condemning the practice as scientifically without justification. From a review of this interesting controversy it very soon becomes apparent that at least some of the conflicting opinions and a good deal of confusion has come about from failure fully to appreciate the scope and complexity of the problem involved. To avoid this it is absolutely essential to begin our study with a comprehensive and clear conception of whatever knowledge we have of the normal physiology of the ovaries. With this as a criterion we may then safely proceed to inquire, from anatomical and histological data, from experimental research, from observations based upon pathological physiology and from the evidence furnished by clinical statistics in what respects and to what degree total ablation on the one hand or conservation of ovarian tissue on the other alters our physiological composite.

THE FUNCTIONS OF THE OVARY

In the light of recent investigations and from a biological point of view, the only conception of the ovary which is tenable today is that it is a complex glandular organ possessing fundamentally a dual function. One of these relates to the phenomena of reproduction of the species, while the other is concerned primarily with the elaboration of one or more specific internal secretions. Let us examine the evidence upon which this conception is based.

Constituents of the normal human ovary. For the present we will omit a discussion of the stroma, the intrinsic nerves, the lymphatics and the blood-vessels, confining our attention to a consideration of the epithelial elements. These consist primarily of varying numbers of graafian follicles, with their contained ova. Secondarily, and originating from these, are the corpora lutea, degenerated or atresic follicles and possibly also, at least during pregnancy, the so-called interstitial glands.

The ovum appears to possess at least a twofold function. Meyer has shown that from the earliest development on to atresia the life of the follicle epithelium depends upon the vitality of the ovum; that the formation and development of the corpus luteum depends upon the maturation and expulsion of the ovum; and that if fertilization occurs, the ovum operates to prolong the life of the corpus luteum. In addition to this fundamental influence upon ovarian elements, the ovum possesses the all-important function of reproduction of the species, which process begins only after fertilization with the male element. In conflict with this generalization, however, are to be mentioned the observations of Loeb that the unfertilized ovum of the guinea pig may undergo limited development, even to the formation of the anlage of the central nervous system, while still in the follicle. But this is not of uniform occurrence and, furthermore, such ova subsequently degenerate.

The corpus luteum is the most conspicuous element of the ovary. Its morphology and development from the collapsed follicle following rupture and expulsion of the

[1]Read before The American Gynecological Society, Philadelphia, May 16, 1918.

ovum have been exhaustively studied and repeatedly described by a number of investigators and need not be repeated here. The various phases of its life cycle are now universally agreed upon with one important exception, which has been made the subject of much study and of prolonged discussion — namely, the origin of the lutein cells, whether they arise from the theca interna, and are, therefore, of connective-tissue origin, or whether they develop from the cells of the membrana granulosa and, hence, are epithelial in nature. Both views have been ably championed. But particular mention should be made of the work of Sobotta and of Sandes on the lower animals and of the recent studies of Robert Meyer and of Novak on the very early stages of the human corpus luteum, because collectively these investigations appear to establish conclusively the correctness of the epithelial theory. Additional evidence, too, in support of this view is to be found in the pointed observation of Frank, that "from a physiological standpoint the corpus luteum behaves like an epithelial structure, and that the entire organism furnishes no example of a gland with either internal or external secretory function which develops solely from mesodermal structures." In connection with the morphology of the corpus luteum, it is important to emphasize two other facts which have been established through these intimate histological studies. One is that the corpus luteum undergoes constant change from day to day in its structure and appearance, first progressive and later regressive in character, indicating, of course, functional activity; the other is the remarkable prolongation of the life of the corpus luteum during pregnancy.

A third epithelial structure in the ovary which demands consideration is the atresic follicle. Relatively few follicles go on to full maturity, rupture, expel the ovum and terminate in corpora lutea. The vast majority of them undergo varying degrees of development usually approaching maturity, followed by gradual disintegration of the ovum and granulosa cells. Coincidently the cells of the theca interna enlarge, become epitheloid in appearance and persist for a considerable time in many species of animals (about 50 per cent of eighty species carefully investigated by Fraenkel), but in woman this occurs only during pregnancy. These are the so-called "interstitial glands."

Since numerically, at least, atresic follicles constitute the most important epithelial element in the ovary, and, further, since they appear to play no part either in menstruation or in reproduction, our ignorance regarding their function furnishes a strong argument for ovarian retention after hysterectomy.

Concerning the function of the other epithelial constituents of the ovary we are now in possession of considerable knowledge, thanks to the studies and experimental researches notably of Loeb, Fraenkel, Ancel and Bouin, Frank, Marshall, Heape, Hitschmann and Adler, Robert Meyer, Ruge, Schroeder, and others. Thus it has been shown that cyclical changes recur with methodical regularity both in the ovaries and in the uterus, and, further, that a definite correlation undoubtedly exists between these respective phenomena. In the ovaries there occurs in orderly sequence (1) follicle ripening, (2) ovulation and (3) corpus luteum formation. Co-ordinated with and dependent upon these ovarian changes there occurs in the mucous membrane lining of the uterus an equally interesting and orderly cycle consisting of (1) premenstrual hypertrophy and hyperplasia, (2) menstruation and (3) regressive changes, followed by a period of inactivity or rest. The evidence appears to be conclusive that these changes in the endometrium are brought about through the specific action of a chemical substance furnished by the corpus luteum. This remarkable structure, furthermore, has been definitely shown to inhibit ovulation, and by so doing it prolongs the sex cycle in lower animals. During pregnancy the life of the corpus luteum is greatly prolonged, and it has been shown to be essential to the early part of pregnancy, since it has a sensitizing action on the uterine mucosa, without which the ovum is unable to implant itself thereon. In all mammals there is a

striking coincidence between follicle ripening and the period of heat, which strongly suggests a stimulation of the sexual mechanism by a specific secretory product.

In addition to these important cyclical phenomena, which are concerned primarily with reproduction, the ovary is known to possess other functions of prime importance. Thus the normal growth and development of the generative tract, together with that of the whole group of secondary sexual characteristics occurring at puberty, are known to depend largely upon trophic influences of the ovary. Likewise, we know that it not only controls the development of the mammary glands but is responsible also for the cyclic changes which they manifest. Furthermore, abundant evidence, both experimental and clinical, is available to establish incontrovertibly the intimate and vital connection of the ovaries with other units of the endocrine system. Particularly is this true of the pituitary gland, the thyroid gland and the adrenal glands. Recent reviews of the studies supporting this assertion have been published respectively by Goetsch, by Marine and by Vincent. Less convincing but highly suggestive are the observations pointing to a possible functional interrelationship between the ovaries and both the parathyroid and pineal glands. The same is true of the possible part played by the ovaries in the general metabolism of the body. Certainly no one can at present deny the possibility, at least, of the participation of ovarian influence in these several directions also. Finally, the equilibrium of the nervous system in the human female, both in the psychic domain and particularly in that of the autonomic constituent, appears to depend exquisitely upon the integrity of the ovaries.

Many interesting and valuable data have been purposely omitted from this brief summary, but we may safely accept what has been said as supplying the physiological composite of ovarian function necessary for the purposes of this study. It strikingly emphasizes at least two facts — namely, that the ovary is a vitally important biological unit, which is constantly playing an important rôle in the body economy, and that its influences are unmistakably discernible far afield from the domain of the reproductive system of which it constitutes so important a part. No more conclusive clinical demonstration of the far-reaching influence of ovarian activity could be reasonably desired than that furnished by the phenomena occurring with menstruation, and with the physiological as well as the artificial or surgical menopause.

A careful comparison of the symptomatology associated with these three conditions reveals the surprising fact that they differ from each other chiefly in degree and rate of development. This fact does not appear to be generally recognized. On the contrary, the numerous references to these varied symptoms encountered in the literature leaves one impressed with the chaotic and confused state of mind which now exists regarding them. There is manifest need of a scientific classification of these vexing phenomena, and, in hopes that an effort in this direction may stimulate discussion and eventually lead to a satisfactory co-ordination of them, I have undertaken, from authoritative sources, first to tabulate and then to classify them. It seems rational to divide them into two great groups: (1) those which arise within the domain of the autonomic nervous system, and (2) those originating in part from activation or sensitization of the spinal reflex arc, and in part from the higher cortical cells of the brain, which collectively constitute the psychic domain.

I. Symptoms from the domain of the autonomous nervous system.
   1. Vasomotor.—Hot flushes; headaches; dizziness; vertigo; fainting; dermatographia; urticaria; erythemata; cold hands and feet.
   2. Cardiac.—Palpitation; tachycardia (mild with normal heart).
   3. Gastro-intestinal (motor and secretory).—Digestive disturbances with flatulence, eructation, nausea and occasional vomiting; stasis; meteorism; constipation; diarrhœa.
   4. Urinary.—Irritable bladder; polyuria.

5. Endocrine.—Thyroid; hyper- and hypo-function; pituitary — e.g. obesity; adrenals — e.g. hypotension; gonads — e.g. changes in libido sexualis, voluptas and secondary sexual characteristics — e.g. voice, body conformation, countenance, facial hair, breasts, and external genitalia.
6. Sweat glands — e.g. sudden sweating.

II. Psycho-Neurotic Symptoms.

1. Psychic.—Fatigability, mental and physical; emotivity; hypersensitiveness; irritability; changed temperament; anxiety and apprehension; insomnia; excitability; hysteria; psychoses; depression; apathy and indifference; lack of energy; impaired memory; aphasia; indecision; self-condemnation; suicidal ideas;
2. Neurotic. — Exaggerated reflexes; tremors and epigastric quivering; visual and auditory disturbances; lowered muscle tonus; paræsthesia.

This classification is merely tentative. It seems to me, however, to be rational, simple and reasonably comprehensive, since it certainly embraces most of the disturbances associated with menstruation and the menopause, whether normal or artificial. It is incorporated in this study to help emphasize the close relationship which exists between the clinical syndromes of these epochs in a woman's life and to accentuate further the scope and complexity of ovarian influence.

We are now in a position to inquire in what respects and to what degree ovarian function, as detailed above, is impaired or disturbed by surgical removal of the uterus.

Anatomical and histological data. From this source we will first inquire whether an adequate arterial and venous circulation of the ovary is assured by the technique commonly employed in the surgical removal of the uterus, particularly when the operation includes removal of the fallopian tubes. The studies on this point of Keitler, Werth, Olshausen, Polak, and particularly of Sampson, show that the blood supply to the ovary from the uterine artery and the drainage from the ovary through the uterine veins is cut off in doing hysterectomy; that the danger to the ovarian circulation is greatly increased through salpingectomy; and finally that failure to recognize these anatomical points is responsible for a large percentage of degenerated ovaries following these operations. I feel that this last point should be stressed, because I am convinced that many of us have jeopardized the function of a conserved ovary through unnecessary surgical damage to its circulation.

We next wish to know from the data under consideration what has been learned from subsequent gross and microscopic examination of human ovaries regarding their ultimate fate after hysterectomy. Unfortunately, the available information on this point is meager, and one must be extremely cautious about drawing conclusions from it. Vineberg, in 1915, was able to glean from the literature and through personal communications reports of only 28 cases of second operations for disease of retained ovaries. In the majority of these the primary operation had been of such a capital nature as to make it highly probable that the ovarian circulation was subjected to unusual traumatism, and at least four of them were associated with malignant disease of the uterus. Graves reported two cases of cystic degeneration and one of papillary cystadenoma found at second operation upon retained ovaries. He adds that he has frequently removed ovaries which had been retained at a previous hysterectomy and in every instance found them densely adherent, degenerated and cystic. On the other hand, Vineberg removed one of two normal-looking ovaries sixteen months after abdominal hysterectomy and found it normal microscopically. Grammatikati examined the ovaries of a woman who died three years after a panhysterectomy for cancer and not only found no evidence of degeneration, but observed follicles in all stages of development. Glaevecke observed two cases six months after hysterectomy and found the ovaries normal in both of them. Weber studies fifteen ovaries obtained long after the menopause and found in four of them follicles in various stages of development, and in one instance a corpus luteum.

The inference from this evidence is that the uterus is not essential to a continuation of ovarian function, and that when ovarian degeneration follows hysterectomy it is to be attributed either to associated ovarian disease or to damaged ovarian circulation or to both of these factors.

Experimental data. Grammatikati was the first to study experimentally the effect of hysterectomy upon the ovaries. He used rabbits for this purpose, and found after an interval of three or four months that microscopic examination of the ovaries showed them to be normal in every detail. Mandl and Buerger incorporated in the most comprehensive monograph that has been published on this subject the results of a much more elaborate experimental study made upon rabbits and apes in which an interval of eight months to three years was allowed to elapse between the removal of the uterus and the subsequent examination of the ovaries. They were able to detect only slight evidences of congestion which they thought possibly interfered slightly with the function of the organ.

Similar results were obtained in experiments by Burckhardt and by Keitler. Martin concluded, from his excellent reviews of the voluminous literature on ovarian transplantation, that autotransplantation of ovarian tissue retards and modifies the symptoms of the artificial menopause precipitated by castration in a definite number of cases, depending undoubtedly upon the graft retaining its vitality. So that the available experimental evidence completely demolishes the theory of an essential physiological interrelationship between the uterus and the ovaries, and demonstrates conclusively that ovarian function, in part, at least, proceeds uninterruptedly after hysterectomy.

The data from clinical studies. Since 1899 when the question of ovarian retention after hysterectomy first received serious consideration, a voluminous literature has accumulated embodying the results of numerous clinical investigations of this problem. Mandl and Buerger's exhaustive monograph contains an excellent review of the earlier contributions, while helpful later bibliographies will be found appended to the more recent articles of Schickele, Walthard, Vineberg, Graves and Culbertson. In reviewing this literature one experiences disappointment over the conflicting opinions met with regarding a number of the points which must be determined from clinical data. I will summarize the results of a few of the most important statistical studies that have been made.

Mandl and Buerger, in 309 cases of total ablation, observed menopause symptoms in 80 per cent. Of these, 49 per cent developed symptoms very promptly after operation. Of 96 cases with retention of one or both ovaries 68 per cent subsequently developed what these authors style as "symptoms of a general nature." In 23 per cent of these the symptoms were only periodic, which they interpret as an indication of functionating ovaries. The sexual function was impaired in 42 per cent of the total ablation cases and in only 18 per cent of the retention cases. The incidence of postoperative obesity, trophic and psychic disturbances, were not strikingly different in the two groups, but the variations observed were uniformly in favor of the retention cases.

Mainzer concluded from his studies that the removal of normal or slightly diseased ovaries causes especially stormy ablation symptoms, and that while retention may not always prevent the later development of symptoms, these are mild and of the menstrual type. He saw no case with retention exhibit the severe syndrome following total ablation.

Burckhardt noted the appearance of menstrual molimina in 22 per cent of his retention cases. Ablation symptoms developed in about one-half of the cases both with retention and total ablation. The sexual function was favorably influenced by retention. He saw no injury to the health of patients from retention and advocated it in order to ameliorate the later menopause syndrome.

Werth, from his exhaustive study of 118 cases, of which 35 were instances of ovarian retention, advocated retention not only before but after the menopause age. He vigorously attacks the idea of frequent oc-

currence of ovarian tumors from retained ovaries, and concludes that the ovary has an important function in the body economy which warrants its retention in spite of certain clinical objections.

Glaevecke attributes the disturbances observed in retention cases to operative injury of the ovary or to coexisting disease. He considers it established that ovulation continues to the normal menopause in retention cases.

Leopold and Ehrenfreund studied 151 cases of hysterectomy on account of myomata, 43 of which were examples of ovarian retention. Of these 50 per cent had disturbances, in one-half of which the symptoms appeared before the climacteric age. They observed no alteration of the sexual function and no trophic disturbances.

Dickinson from a careful study of 131 cases of ovarian retention after an interval of six months and over subsequent to hysterectomy concluded that 80 per cent were free from menopause symptoms; that the results were better in cases with retention of both ovaries than with only one or than after resections; that the disturbances met with were more gradual and less severe than after total ablation; and that retention in operations for pelvic infections is relatively less satisfactory. He condemns the removal of healthy ovaries at or near the time of the menopause, since the exact period of ovarian activity is unknown. He has not had to reopen an abdomen when a conservative operation was done.

Graves last year reported his findings in a postoperative statistical study of 233 cases of total ablation and 26 cases of ovarian retention after hysterectomy. His clinical data appear to have been obtained through letters of inquiry sent to patients with reference particularly to one symptom — namely, hot flushes. This symptom he chose as a standard, and found it in 80 per cent of the total ablation cases and 81 per cent of the retention cases. He states that it was reported by many patients who had passed the natural menopause at the time of the operation, and he considers this fact evidence that the ovary retains its influence as a secretory organ long after ovulation ceases. But in spite of this admission of continuation of ovarian function long after cessation of uterine function, he contends that normal ovarian function is dependent upon a vital physiological connection between the ovary and the uterus. Hot flushes he seems to regard as tantamount to cessation of all ovarian function and, employing this arbitrary standard throughout his study, he reaches the remarkable conclusion that retention of ovarian tissue after hysterectomy is of little or no physiological value.

Such radical teaching should not be permitted to stand unchallenged, especially when it rests upon so insecure a foundation as clinical data compiled from letters of inquiry and classified according to the incidence of hot flushes, upon the unique assumption that this symptom alone may be safely accepted as a reliable and scientific indication of the varied and complex activity of the ovary.

Graves supports his advocacy of total ablation by citations respectively from Walthard and his associates, from Schickele and from Konstantinidis, to the effect that menopause symptoms occur with equal frequency in cases of retention and of ablation. But a careful examination of these several reports shows that in them it was not the purpose of any of these authors to advocate total ablation. Thus, Schickele says a "vasomotor symptom-complex" occurs in retention cases as often as in ablation ones. He insists, however, that these phenomena shall be designated as "retention symptoms" in the cases with retained ovaries, in contradistinction to the "ablation symptoms" of cases with complete removal of ovarian tissue. He states, further, that the retention symptoms need to be further studied. The inference, of course, is that he recognizes differences between the two clinical syndromes, an observation which certainly does not support the theory of total ablation.

Walthard, while at Berne, Switzerland, through the influence of Professor Paul Dubois, became enthusiastically interested in the psychoneurotic side of gynecological patients. His report includes three extremely interesting tables. The first one shows that

of 64 cases studied prior to removal of their pelvic organs, seven commonly recognized ablation symptoms were found in percentages varying from 14 to 46. The second table shows that after a period of at least one year subsequent to total ablation of the pelvic organs, in 51 of these same cases examined the seven ablation symptoms were found to have completely disappeared in from 7 to 23 instances. The third table shows that of 65 cases with normal genital organs, and free from any other organic disease, nine of the common ablation symptoms were demonstrable in percentages varying from 44 to 64. The age of the patient was found not to be a factor in any of the groups studied. Walthard concludes from this investigation that the so-called ablation symptoms are neither the direct necessary result of any genital disease nor of the loss of internal secretion of the ovary, nor of the loss of the genital function. He considers them due to a hypersensitive nervous system and psychoneurotic in origin. Whether we agree with him or not, his report certainly cannot be considered as supporting total ablation. It does, however, strikingly emphasize the caution which must be observed in the present state of our knowledge in drawing conclusions regarding ovarian function from the incidence of one or more so-called ablation symptoms.

Finally, Konstaninidis reported a postoperative study of 100 cases of hysterectomy with retention of both ovaries and 34 cases with retention of one ovary. One sentence from his summary states that of these 134 cases, one-half showed more or less vasomotor, nearly one-third trophic and about one-seventh psychic disturbances. This sentence has been used by the advocates of total ablation to support their contention. But a careful reading of the full report shows that it cannot be justly so construed.

Of the one-half with vasomotor disturbances, in only 37 per cent of them were these symptoms severe, and nearly one-half of these were furnished by the group from whom one ovary had been removed. Of the one-third exhibiting trophic disturbances, by which the author means a slight tendency to adiposity, only 23 per cent were found in the group in whom both ovaries had been retained. Furthermore, a majority of all the patients showing this tendency to adiposity were at the normal menopause age. This study, therefore, argues eloquently for ovarian retention.

These citations represent fairly the available clinical data and suffice to illustrate the conflict of opinion and confusion which such studies have brought about. The truth of the matter is that no clinical investigations have been made with proper regard for all of the various factors which in reality determine the fate of retained ovaries, and without knowledge of which one cannot possibly estimate with any degree of accuracy to what extent hysterectomy has disturbed their function. These factors are (1) a knowledge of the individual patient's condition prior to hysterectomy, both in the psychic domain and in that of the autonomic nervous system as already outlined; (2) the cases must be grouped according to age both at the time of operation and at the time of subsequent observation; (3) they must be grouped according to the pathology for which the operation was performed; and (4) with reference to the operative technique, whether or not proper measures were used to safeguard subsequent ovarian circulation.

CONCLUSIONS

1. The ovary is a glandular organ of complex function, our knowledge of which is at present far from complete.

2. The uterus is not essential to a continuation of ovarian function, except as regards menstruation and reproduction.

3. The advocates of total ablation have not furnished convincing evidence of the correctness of their contention.

4. The disturbances of ovarian function attributed to hysterectomy are partly those associated with normal menstruation and partly those arising from damage to the ovary through operative trauma or disease.

5. The weight of evidence furnished by anatomical, experimental, and clinical investigations is overwhelmingly in favor of retention of sound ovaries both before and after the menopause age.

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PATHOLOGY OF GOITER

BASED UPON SPECIMENS RECEIVED AT THE STATE INSTITUTE FOR THE STUDY OF MALIGNANT DISEASE, BUFFALO, NEW YORK

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IN writing upon the pathology of goiter, it seemed to me to be a good plan to classify all the thyroid specimens which came into the laboratory for diagnosis. This ought to give a fair pathological classification especially for the immediate region of Buffalo, from which we naturally receive the majority of our specimens. As is well known, the term "goiter" is a purely clinical one and is usually given to any permanent enlargement of the thyroid gland.

The classification which I have indicated below seems to embody all the pathological conditions in which we find enlargement of the gland.

CLASSIFICATION

Simple goiter.
- A. Physiological
- B. Toxic

Multiple adenomata.
- A. Cystic
- B. Solid

Colloid goiter.

Exophthalmic goiter.

Neoplasms.

Acute or chronic inflammations are not included in this classification. The specimens received at the laboratory may be almost entirely put into the last four divisions. Simple goiter usually does not come to operation, especially in the early stages, and moreover, many of these cases either recover spontaneously or are amenable to medical treatment.

There are, especially in Europe, in the mountainous regions, areas or districts which are known as "goitrous districts" in which the so-called endemic goiter is very common.

In these places a large proportion of the population are affected by markedly enlarged thyroids. Buffalo, in common with other cities on the southern borders of the Great Lakes, is considered a goitrous region although we have only the incipient endemic goiter and rarely as marked as that common in the European goitrous regions.

Under the clinical term "goiter" we have grouped five distinct and separate diseases. The only thing which they really have in common is the enlargement of the thyroid gland, this being the usual sign for which the medical man is consulted.

I wish to take up each group, speaking briefly concerning the etiology, gross and microscopic pathology. It might be well to review briefly the histology of the thyroid gland. The thyroid gland takes its origin from the upper, anterior portion of the gut tract, being, therefore, derived from the endoderm. The gland consists of two lateral lobes connected by an isthmus. It has a thick connective-tissue capsule which sends down trabeculæ which divide the gland into lobes and lobules. The unit of the thyroid gland is the follicle, a little sac which is lined with a single layer of low columnar epithelium, the basal ends of which come into intimate contact with capillary blood-vessels, the lumen of these little sacs or vesicles being usually filled with colloid material, the active secretion of the thyroid cells. The follicles are surrounded by a rich network of lymphatics into which many authorities believe the secretion may be thrown, although by others it is believed the secretion is absorbed directly into the blood stream. These follicles do not communicate with each other but are grouped into lobules by connective tissue and surrounded by trabeculæ sent in from the capsule.

SIMPLE GOITER

The first group, simple goiter, may be divided into a physiological simple goiter and toxic simple gotier, using the word toxic in an etiological sense.

Physiological simple goiter is the term applied to the temporary enlargement of this gland which occurs at puberty, during menstrual periods and especially in pregnancy. The exact cause of this enlargement is not known but the mechanism of the enlargement is usually due to vascular dilatation. It probably has some relation to the sympathetic system. The gland is slightly enlarged, smooth and usually symmetrical. This enlargement is generally only temporary but repeated physiological enlargement may lead to simple goiter which is accompanied by true hyperplasia, probably due to repeated irritation and increased blood supply.

Toxic simple goiter is that variety of true goiter which occurs with such frequency in certain mountainous regions and is usually designated as "endemic goiter." It is also the type which we see in younger people along the cities of the Great Lakes. Marine has made a study of the girls of the schools of Akron, Ohio, examining the thyroids of 3,872 from the fifth to the twelfth grades, ages averaging from twelve to seventeen, and found that 56 per cent showed enlargement of the thyroid gland. This is the type of simple goiter which occurs in Buffalo and its environments. Among the chief theories for its causation may be mentioned especially those of Bircher and of McCarrison, each of which we will briefly allude to. There are two factors in the etiology of goiter that nearly all authorities are agreed upon, that is first, the relation of drinking water to goiter and, second. an especial susceptibility of some thyroids to certain influences. One of the older theories and one that was accepted for some time was that of Bircher, who believed that the changes in the thyroid gland were due to toxic material which he took to be a chemical of a colloid nature and was associated with water of the so-called goitrous wells or streams which nearly always spring from certain of the older geological strata. This water originated or passed through certain organic sediments deposited in these layers. H. Bircher, when examining recruits in military service, noted that certain groups of individuals from certain districts showed enlargement of the thyroid gland. After the war he investigated these districts and noted the relation to the drinking water. He also observed in a neighboring town the great difference in the prevalence of goiter on either

side of the stream which ran through this town, people on the right bank having 80 per cent of goiter while on the left bank only about 2 per cent. The water supply was obtained from different sources. By changing the supply of the high goitrous district and obtaining water from the other side of the stream, the goiter incidence was reduced to 2 or 3 per cent. He found that these so-called goiter wells or streams had their origin in certain geological strata as mentioned above. His son, Eugene Bircher, carried on animal experiments, especially with rats and found that by feeding these rats upon drinking water from the so-called goitrous wells, he was able to produce enlargement of the thyroid gland in these animals.

The second theory is that of McCarrison, who worked in the region of the Himalaya Mountains in India. McCarrison made extensive investigations in a goitrous district and came to the conclusion that the thyroid changes were due to toxic substances of infectious origin and that the chief seat of the infection was to be found in the intestinal tract. His experiments are very convincing. He was able to produce enlargement of the thyroid gland by feeding fæcal matter from goitrous people to animals. He also fed the precipitate on Berkefeld filters which was obtained by filtering water from goitrous wells, to humans, producing thyroid enlargement and was successful also in curing certain cases by the use of intestinal antiseptics, as thymol, salol, etc. McCarrison speaks of several cases of enlarged thyroid which were caused to disappear by operative procedure on intestinal conditions, especially in Lane's kinks, etc. One remarkable case which he reports cured by this means was in a girl with a severe case of exophthalmic goiter. While McCarrison isolated anaerobic organisms from the intestinal canal in goitrous patients, and had some success using this organism as a vaccine, he does not claim to have found a specific organism but thinks that organisms of the colon group may be largely responsible.

Marine, who has done extensive work on the thyroid gland, especially on the lower animals, believes that the enlargement of this organ in simple goiter is often associated with the lack of ability of the body to get iodine or to assimilate the same; and that, therefore, the thyroid gland hypertrophies to compensate for this condition.

Simple goiter occurs at any age but is more frequent between the ages of twelve and twenty, and while this condition occurs in males, it is much more frequent in females. The gland is usually small, symmetrical and smooth; although either lobe may be enlarged over the other or the enlargement may be located in the isthmus. Microscopic examination shows a hyperplasia, that is, an increase in all the constituents and also a new formation of vesicles. This increase is symmetrical. While the epithelium becomes high cuboidal or columnar, still there is no tendency to papillar formation or an increase in the layers lining the alveoli. The colloid material is usually increased and stains more deeply than in the normal thyroid gland. It is to this type of thyroid enlargement that the name of goiter properly belongs.

MULTIPLE ADENOMATA

By far the greatest number of the enlarged thyroids received at the laboratory with the diagnosis of "goiter" is really true tumor formation. Whether or not true statistics of all cases of enlargement of this organ would show that the majority comprises the group of multiple adenomata, or if this form is the most frequently operated upon, nevertheless, the fact remains that 65 per cent of all enlarged glands received at the laboratory are of this type. It is a true tumor formation and is usually multiple. The accepted etiological factor is that these tumors spring from remnants of ducts which it is supposed were to be found in the organ, when, in former times, it was a duct gland. It is easy to find these remnants of ducts, with their high columnar epithelium, in thyroids of the newborn. While these nodules or adenomata may appear at any time after birth, they usually are to be found at puberty and make their appearance at this time, and gradually enlarge, until at the age of thirty or thirty-five years, they become marked goiters.

It is interesting, with the knowledge which

we have of the frequency of this type of enlargement, to read in various treatises on the thyroid, how the author dismisses this type of pathological condition, apparently with a wave of the hand, with the remark that sometimes Wolfler's fœtal adenomata are to be found in the thyroid gland and this is especially striking when as a matter of fact Aschoff in his lectures, claims that he can find these adenomata in the thyroid gland of every individual who comes to autopsy from the region of Freiburg in Breisgau. The writer found them in 80 per cent of two hundred consecutive autopsies in this region.

This type may be divided into two histological classes: the cystic and the solid.

It is to this variety of enlargement of the thyroid gland that we have the many different names, as cystic goiter, fibrous goiter, hæmorrhagic goiter, etc., and is only in this variety that the conditions exist which give rise to these various names. The tumor mass is usually irregular and nodular and for this reason has been given the name of "struma nodusa." Early this form may be confused with simple goiter, and later, the cystic variety may be confused with colloid goiter. Section of these enlarged thyroids show all the so-called "degenerative changes" and various colors which are due to hæmorrhagic changes and calcareous infiltration. One can follow the growth of these tumors from the small nodules to the large diffuse adenomata or cystic areas. They are differentiated from all other forms of enlargement of the thyroid gland by the distinct nodular tumor masses even though they be cystic and colloid. All other forms of goiter still retain the characteristic lobular form of the gland, the pathological areas being separated by trabeculæ, while the true tumor formation shows no trabeculæ dividing them into lobules. In some cases the surrounding thyroid tissue becomes compressed, forming capsules to these nodules.

The cystic variety is composed of large vesicles filled with colloid material, the secretion of the tumor cells, and as lymph vessels are not contained in these tumors, there is no absorption of this colloid secretion, which thereby accumulates and forms cystic structures and in this way may resemble the colloid goiter. Also in this variety, probably due to the effect of secretory materials on the smaller vessel walls, there is great tendency to hæmorrhage.

The solid variety is very cellular with high columnar epithelium containing very little colloid material. As these adenomata increase in size, they always show degenerative changes at the center, the tumor cells undergo necrosis and their places are taken by newformed connective tissue which soon undergoes especially hyaline degeneration. In some cases the epithelium proliferates irregularly and no doubt these cells secrete material which gives toxic symptoms, for our statistics show that 3 per cent of the enlarged thyroids diagnosed as "exophthalmic goiter" showed, upon microscopic examination, to be very cellular adenomata.

COLLOID GOITER

Nineteen per cent of the specimens received were colloid goiter. Colloid goiter might be designated as a passive enlargement of the thyroid gland, it being simply a collection of colloid material, filling the alveoli until their walls become very thin and sometimes rupture into each other. It is considered that colloid goiter is really a healed goiter, that is, at one time the thyroid gland was the seat of either thyroiditis, simple goiter, exophthalmic goiter or some other pathological condition; and the cause of these being eliminated, the active process ceased and the cells continued to secrete colloid material but the absorption of this apparently is interfered with and it accumulates in the alveoli.

These goiters are large and symmetrical with a smooth surface. Cut surface shows large alveoli filled with colloid material. Microscopically the alveoli are large, filled with thick colloid material. The epithelium is compressed and flattened. In this type of enlarged thyroid we do not find the so-called degeneration or evidence of hæmorrhage, and the lobular arrangement, while greatly enlarged, is still preserved by the trabeculæ.

EXOPHTHALMIC GOITER

Eight per cent of the specimens were exophthalmic goiter. There is considerable controversy concerning the etiology of this

disease, the main question being whether the disease is primary in the thyroid gland or primary in the nervous system, especially the sympathetic. Crotti, after a careful and elaborate discussion of the observations and experiments in this disease, concludes that the disease is primary in the thyroid gland, being a toxic irritation from infectious toxins from various sources, as the intestinal tract, pyorrhœa, tonsillitis, or other chronic infections. He does not, however hold that there is a specific organism. He speaks especially of a vicious circle, that is, the infectious toxin stimulates the thyroid to throw out its secretion which stimulates the sympathetic nervous system which in turn stimulates the thyroid again, in this way forming the so-called vicious circle. An interesting observation is that exophthalmic goiter is uncommon in regions where simple goiter is endemic.

The thyroid gland is not greatly increased in this disease. It is usually symmetrical but may be more marked in one lobe. In some cases the gland may not be clinically enlarged but in every case there is a specific pathological picture of hyperplasia of the gland. Cut surface reveals compact areas, grayish in color, and shows no exudate. Histologically, the alveoli are increased in size and number and become very irregular in shape. The epithelium is high columnar and may be several layers thick and with marked tendency to papillar formation, which is almost pathognomonic for this disease. Colloid material is decreased and may be entirely absent from the follicles, but when present stains rather faintly.

NEOPLASMS

I have added the neoplasms because 4 per cent of all the thyroids received show malignant disease. While the thyroid may be the seat of benign tumors, as fibromata, chondromata, etc., these tumors are the same as occur in other parts of the body, springing from the mesoblastic tissue. Sarcoma is not rare and is usually of the spindle-cell variety, and springs from the connective-tissue element. It is no more specific for the thyroid than for other tissues of the body and usually originates in a normal gland, in younger persons.

Ninety per cent of the carcinomata spring from pre-existing goiter and occur in individuals past forty. One should be suspicious of malignant change when a goiter in a person past forty suddenly begins to enlarge in size. Malignant epithelial tumors of the thyroid gland have a great tendency to metastasize in bone. It is also possible to have metastatic thyroid tumors from enlarged thyroids which do not give a histological picture of malignancy.

DISCUSSION

In reading various articles upon goiter one is struck by the apparent lack of uniformity in the classification of these conditions. As I have said, goiter is a clinical term and is sometimes employed indiscriminately to any enlargement of this organ. It is the opinion of the writer that much confusion exists by the classification of various distinct processes under one head, especially in goitrous regions, and by statistics upon the collection of these various conditions. It is well to keep in mind that simple goiter is probably a toxic hyperplasia of the thyroid gland in younger people, especially females, and occurs between the ages of twelve and twenty. This process in the majority of cases spontaneously recovers but may continue and may reach the colloid healed state. At about the age of twenty the adenomata proliferate in the thyroid gland and begin to evidence themselves by the appearance of marked enlargement of the gland, and from twenty to forty we have the adenomata type of enlargement. This may occur in glands which have been the seat of simple goiter or may occur in glands which have been apparently normal. So we may, therefore, have, before twenty, the simple goiter and after twenty, colloid goiter or adenomatous goiter. Exophthalmic change may occur in the normal gland, in the gland, the seat of simple goiter, in colloid goiter or in adenomatous goiter.

RECAPITULATION

To recapitulate briefly, the specimens of enlarged thyroids which come to the laboratory for diagnosis can be classified into five groups, namely: simple goiter, multiple

adenomata, colloid goiter, exophthalmic goiter, malignant neoplasms.

These are all characterized by the common factor of enlargement of the thyroid but otherwise differ markedly from one another. They may be differentiated clinically in nearly all cases by careful examination which seems to be desirable for the selection of proper treatment. The physiological simple goiter is simply a vascular dilatation and is goiter only in the sense of the enlarged gland which, however, is often only of temporary duration.

Simple toxic goiter is an enlargement of the thyroid gland due to a symmetrical hyperplasia of all the structures of the thyroid and without the clinical evidence of toxic symptoms, most probably caused by toxic factors. This form which is usually called endemic goiter is almost always associated with drinking water which probably has to do with carrying the infection or toxin.

Multiple adenomata is the most common cause of thyroid enlargement in our vicinity, at least so far as our statistics show, which are, of course, based upon operative material sent in to the laboratory. It is a true tumor formation, beginning probably in remnants of embryonic ducts occurring about the age of puberty. These tumors start as minute adenomata in different parts of the gland and gradually increase in size causing the nodular form seen in later life and having a great tendency to the so-called degenerative changes which give this form of enlargement its numerous names. It is well to remember that these adenomata when very cellular may give toxic symptoms and thereby become confused clinically with exophthalmic goiter.

Colloid goiter is simply a passive accumulation of colloid material in the dilated alveoli and it is usually considered as a healed state of some previous pathological condition of the thyroid gland.

Exophthalmic goiter, even if it be not of primary thyroid origin, has its specific pathognomonic histological picture, and there can be no doubt of the toxic effect of the excessive secretion of this gland.

The neoplasms really ought not to be included in a goiter problem and are only included here because they make up a part of the enlarged thyroids received at the laboratory.

In closing, I would draw your attention to the fact that 5 per cent of the thyroid specimens received at the laboratory showed a combination of some of these lesions, that is, colloid goiter may show adenomata and a large adenomatous goiter may show areas of true Grave's disease. Considering this fact it may explain that certain unfavorable results in operative procedure may be due to leaving part of an area of exophthalmic goiter in the removal of an adenoma or of a colloid lobe.

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HYPERTROPHIC STENOSIS OF THE PYLORUS IN INFANTS

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THIS condition was first described by Hirschsprung (1) in 1888, but not until 1897, has much appeared in the literature. Since then, however, the condition has attracted more and more attention until within the last decade much has been written upon this subject.

We regard this condition as a distinct pathological entity and we feel that it should not be confused with those gastric disturbances which sometimes present some of its symptomatology. One can not help but realize that many children have heretofore been sacrificed because this condition was not recognized. This is unquestionably due to the fact that many authorities believed the condition to be due to a pyloric spasm. Every one seems to be agreed that pylorospasm does occur in neurotic infants and produces vomiting, but there are few clinicians now who do not recognize the difference between this condition and hypertrophic pyloric stenosis.

PATHOLOGY

We regard this condition as a congenital hypertrophy of the pylorus muscle, which is seldom sufficient to produce obstruction, but when obstruction does occur it is due to a spasm of the hypertrophic pyloric muscle. These cases which appear to be cured by medical treatment are not cured of the hypertrophy, but are relieved of the spasm. Indeed, Holt (2) cites instances in which he could still palpate the tumor in medically cured cases where no surgery was done. On the other hand Lewis and Grulee (3) have shown that the hypertrophic muscle remains for years after a posterior gastro-enterostomy. So also has Scudder (4) shown this. Rosenheim (5) had a case of a boy 6½ years old in whom the symptoms had existed off and on since infancy. Other reasons for considering it a congenital condition are that it is often found with other anomalies such as club foot, hair lip, etc. Hill (6) cites two cases occurring in one family with a history of its occurring before. There is sufficient time for the hypertrophy to take place before birth since we know that the pyloric muscle begins to appear at the end of the third month of fœtal life. Cautley (7) cites a case of Dent's, in which he found it in a seven months' fœtus. In one of our cases it was demonstrated on the third day of life, the child apparently having been born at term. There are a few who hold the belief that constant spasm produces an overdevelopment of the pyloric muscle. However, the evidence of the congenital origin of the hypertrophy seems to be in preponderance to us. Holt (8) says that spasm has never been known to produce hypertrophy.

SYMPTOMS

This condition is attended by a very definite symptomatology, which in itself should serve to make a diagnosis. If every infant be carefully observed the diagnosis between it and other gastric conditions associated with nausea and vomiting should be made.

According to Hill (6) it occurs in one in every 200 babies. The onset is always abrupt. It is seen most often in breast fed, male infants. Holt (8) found 52 out of 56 cases were in breast fed children.

Vomiting. It usually begins at the end of the third week, but may occur earlier or later. The vomiting is projectile in character. It does not often attract the attention of the mother at first, but is so characteristic later that a diagnosis can almost be made by it alone.

The material vomited depends not upon the quality of the food taken, but upon the quantity. It occurs during or at the end of the feeding, sometimes ejected several feet

from the child's mouth. There is practically never eructating or spitting of food in small quantities. The child may not vomit each time that it is fed, but if it retains one meal and vomits at the end of the second, it will vomit both meals at one time. Changing the character of the food may improve the condition for a few days, but it returns, *always*. The vomited material consists of the food taken plus hydrochloric acid, mucus and some epithelium. If we insert the tube after vomiting, the stomach will be found to contain generally, a small quantity of this material in addition to what has been vomited, showing the constant presence of dilatation of the stomach. The vomited material never contains bile or any of the intestinal secretions. On inspection the upper abdomen seems to be full and tense while the lower abdomen is flat and flaccid.

Peristaltic waves. If the child is stripped and observed repeatedly, while feeding, in almost every case we can see, in the upper abdomen, peristaltic waves passing from left to right *across the median line*, becoming more and more violent as the stomach fills, showing its effort to overcome the obstruction at the pylorus, being ball-like in appearance and more or less rhythmical. Just before vomiting occurs one can often see a reverse peristalsis, and after one or two of these waves pass backward from right to left the vomiting occurs.

Pyloric tumor can be elicited in 80 per cent of the cases. Holt (8) claims that it is easier to find when the stomach is empty than when full. Our experience bears him out on this point. Its presence is not essential to diagnosis and it is not so important a symptom as the projectile vomiting and true gastric peristaltic waves. The tumor is described as a small mass the size of a lymphatic gland in the right upper abdomen, always freely movable, varying in size depending on how long the symptoms have existed. In other words it is much easier to palpate when the case has existed for some time and the symptoms of obstruction have been pronounced, though one of our cases had a tumor which was palpated easily causing complete obstruction while the patient was only three days old at operation, and where obstructive symptoms existed from birth.

Amount of retention. In milder cases where the obstruction is not so complete the amount of retention of food is often a great help. Food in diluted form is given. At the end of three hours, if the food is not vomited, it is removed with a tube and the contents measured and recorded. In some cases where the child is almost moribund it is too weak to vomit, and the vomiting occurs only once or twice in 24 hours. The amount of food recovered gives you a very good insight into the amount which has passed the pylorus and the severity of the obstruction at the pylorus.

Constipation is another symptom depending upon the obstruction. In the most severe cases the stool is afæcal and consists of bile, pancreatic juice, mucus and epithelium, but no food particle. It resembles meconium. In other less severe cases, we find small, sometimes very hard constipated stools containing fæcal matter, requiring enemata and suppositories.

The use of the X-ray is of very little value. Holt (8) regards it as of no value, while Richter (9) says its use should be limited not to determine the patency of the pylorus, but to observe the rate of emptying of the stomach. A little of the bismuth meal may pass the pylorus, but that does not tell the story of the afæcal stool and the steady loss of weight.

CASE REPORTS

CASE 1. L. L., age 4 weeks, male, breast fed, weight 7 pounds 4 ounces. Vomiting occurred after each nursing for one week and constipation had been present for 10 days. The child was born of the mother's first pregnancy which terminated in normal labor at term. Birth weight 8 pounds. The child nursed twenty minutes every 3 hours and did well up to one week ago when he began to vomit, small amounts at first and not after each nursing. The vomiting increased in frequency and quantity for three days when the baby vomited after each nursing and the mother thought all that he took. The vomiting was not projectile. The patient seemed hungry all the time. Physical examination showed a fairly well nourished child, skin of good color but a little lax. No gastric wave was seen, no tumor felt. The mother was advised to nurse the baby ten minutes every three

hours, and a lavage given four times a day. One week later the mother returned to the office and reported that the baby had been spitting up much less in quantity, only about one tablespoonful after nursing and not after each nursing, but three or four times a day; for the past three days one to three tablespoonsful three times a day, not projectile. The child weighed 6 pounds 12 ounces. The child was still hungry and still constipated. There was no gastric wave and no tumor felt at this visit. Four days later the mother returned with a very different story. The baby looked much worse and the mother said that the baby had vomited everything taken for the past 48 hours and stated that it spurted from the baby's mouth. At this examination the baby showed typical gastric peristalsis crossing the median line and a large easily felt tumor. At this time we wondered how we could have missed feeling it at the previous examinations. Weight at this time was 6 pounds 4 ounces, a loss of a whole pound in two weeks. Six hours later he was operated upon by Dr. Green and a very hard cartilaginous-like tumor of the pylorus was demonstrated. The Rammstedt operation was done requiring twenty minutes. The patient made an uneventful recovery and was discharged from the hospital in ten days having gained 8 ounces. His retention taken one time only three hours after feeding was 60 cubic centimeters.

CASE 2. N. D., age 21 days, one of twin boys, weight 7 pounds 6 ounces, breast fed. The child had been vomiting for two weeks, and had marked constipation for ten days. The vomiting was not marked for the first week, only about three times a day and about three tablespoonsful at a time but always came immediately after nursing. For the past week the vomiting had been projectile and after taking anything by mouth, even water. He had lost much in weight. He was very much smaller than his twin brother who was smaller than he at birth. The family history was negative. Examination showed a poorly nourished baby with eyes sunken and skin wrinkled and non-elastic. Projectile vomiting was very marked, there was typical gastric peristalsis and a hard easily felt tumor. Stools were afæcal. Gastric retention 30 cubic centimeters three hours after nursing. The child was seen at night in consultation and an immediate operation was advised but it was the following day before consent to operation was given, and at operation a very typical cartilaginous-like tumor was found, the Rammstedt operation done in 18 minutes. The recovery was uneventful and the patient was discharged on the seventh day having gained 4 ounces. At 12 months of age he weighed 24 pounds which is three pounds more than his twin brother.

CASE 3. M. W., age 3 months, 1 week; girl; weight 8 pounds 10 ounces; breast and bottle fed. Vomiting occurred after each nursing for nine weeks; constipation had been present for six weeks. She was born of the mother's first pregnancy which terminated in normal labor at term. The child had been breast fed exclusively for four weeks at which time the baby began to vomit and a bottle was advised. For the past two months she had had a number of different formulas all of which proved unsuccessful. The baby seemed very hungry but would vomit about an ounce just after or a few minutes after finishing the bottle and would repeat this once or twice before the next feeding. Examination showed a poorly nourished, pale child with gastric peristaltic waves but no tumor could be felt. The patient was given medical treatment for three weeks and a modified formula and breast milk, varying strengths during this time but there was no definite improvement. A gastric lavage was given four times a day for ten days and then four times a day with no definite improvement, but rather to the contrary the child was losing ground steadily but not so rapidly as the mother said it had the month previous. Gastric retention three hours after feeding repeatedly showed 60 to 80 cubic centimeters; on two different occasions 4 hours after a feeding 30 to 40 cubic centimeters. During medical treatment for three weeks there was a loss of 10 ounces and she was not improving as we felt she should. At no time was a tumor felt by either of us or by two other colleagues. In the face of the loss of weight, the typical gastric peristaltic waves and the failure to respond to medical treatment, we advised operation as we feared to wait too long. A Rammstedt operation was done and a medium sized, soft pyloric tumor was found. During the

Fig. 1. Case 1 at 12 months. Weight 24 pounds. Operated on at 6 weeks.

Fig. 2. Case 5, five months of age. Operated on at 3 days of age.

operation the mucous membrane was punctured and additional time was consumed in closing the puncture but the operation was finished in 25 minutes. The patient was somewhat shocked from the operation and had a stormy postoperative course for three days, running a temperature 101 to 103°, and vomiting considerably the second and third days when at one time definite fæcal vomiting occurred. But the vomiting ceased rather suddenly on the third day and the convalescence was uneventful from then on. At 10 months the baby weighed 18 pounds and has had no more gastric disturbances.

CASE 4. D. H., age 6 weeks, male, breast fed, weight 4 pounds 8 ounces. The child had vomited, was constipated and had lost weight for three weeks. For ten days the vomiting had been after each nursing and was projectile in character. The mother had one other baby who had lived six weeks, the cause of death not being known. There had been no miscarriages. The child was seen at midnight in consultation with another doctor and was found to be in extremely bad condition, the cry was very feeble, the pulse barely palpable, and the eyes sunken. A most typical peristaltic wave was present and an easily demonstrated pyloric tumor, quite large and very hard. The baby was taken to Wilmington the same day which was some 90 or 100 miles away and a Rammstedt operation was done after hypodermoclysis had been administered twice and some cardiac stimulants given. At the operation a very large, quite hard, pyloric tumor was demonstrated. The operation was completed in 10 minutes for we appreciated that speed was most important to save the baby's life. The child had an uneventful recovery and the only reason he was kept in the hospital longer than any of the other cases was because the parents lived out of town and we thought it most important to give the baby a good start before turning him over to his mother to be taken care of, especially since her milk supply was scant and so scant that we had to get a wet nurse to assist her to nurse the baby. When the baby was operated on he weighed 4 pounds 8 ounces and when he was discharged three weeks later he weighed 5 pounds 15 ounces. His weight at 6 months was 12 pounds 14 ounces, and he was still nursing his mother.

CASE 5. B. S., age 1 day, female, never put to the breast, weight 6 pounds. Projectile vomiting persisted since birth. The mother was taken to the hospital after delivery on account of repeated convulsions. She had been unconscious since a few hours before the baby was born and the convulsions had continued for thirty-six hours after the birth. There are five other children all living and well, no miscarriages. Six hours after the baby was born the nurse gave the child one ounce of warm boiled water which she vomited immediately, with considerable force. This she kept up after each feeding of sugar solution 5 per cent until she was operated on. Examination showed a very plump newborn baby who appeared hungry whenever fed, but who vomited immediately after feeding and at times during the feeding. Lavage was given twice a day with no relief of symptoms. The retention three hours after feeding showed 5 to 10 cubic centimeters of practically clear fluid. There were seen very typical peristaltic waves, and a tumor about the size of the pea in the usual region was felt. The urine was scanty, the stools meconium, of course, but only two in three days. On account of the age of this patient we wondered if we might not have some very unusual condition, such as an atresia of the duodenum or a band constricting some part of the duodenum. We felt that either could produce the peristaltic waves, but they could not account for the tumor. An operation was advised and a small, moderately soft, but definite pyloric tumor was found. The duodenum was in perfect condition. With the exception of a slight hæmorrhage from one of the stitches the recovery was uneventful. For this 20 cubic centimeters of fresh human serum was given and the bleeding ceased. At three months she was nursing her mother 20 minutes every three hours and weighed 9 pounds.

CASE 6. M. O., age 6 weeks, male, weight 7 pounds. Vomiting had persisted after each feeding for three weeks, constipation for two weeks. The

child was breast fed and nursed whenever he cried and that was nearly all the time. The child was born of the mother's first pregnancy, which terminated in normal labor at term. Birth weight 6 pounds, 8 ounces. The child was seen only once at the clinic, and on examination very typical gastric peristaltic waves were seen, and after feeding or during the feeding he ejected at least two ounces of sour curded milk to a distance of one foot. No tumor could be felt at this examination. The mother was strongly advised to let the child stay in the hospital for observation but she refused and also refused to let either a doctor or a nurse see the child afterwards for fear that they would operate on the baby. Indirectly, through other patients in the same neighborhood, I kept some track of the baby. The baby continued to vomit, to what extent I could not say, but it did continue to a greater or less extent for six weeks after I saw the baby, and then the vomiting became less. Now the baby is gaining in weight and vomits very little according to the report. If this was a case of pyloric obstruction, which of course, we can not say definitely, it was a spontaneous improvement.

TREATMENT

When this condition was first described, it was assigned to the surgeon for treatment. His results, however, were so discouraging that other methods were attempted; in some instances with flattering results, notably a series of cases treated by Hutchinson, with 20 per cent mortality. We are inclined to think that many of these so-called medical cures were after all cases of pyloric spasm and not hypertrophy. Granting that they were hypertrophic, they were relieved of the spasm, which had supervened on the hypertrophy and produced obstruction, and allowed to go on with the hypertrophy, which is always prone to relapse. Since 1905, however, with the perfection of the technique of gastro-enterostomy the surgical treatment of this condition has once again occupied the foreground. Scudder (10) reports a series of 36 gastro-enterostomies covering his cases, Richter's and Stillman's, with a mortality 13.8 per cent, while others show an improvement in their mortality percentages as time goes on. In 1913 Rammstedt (11) describes his operation of dividing the pyloric muscle fibers down to the mucous membrane, and partially separating the muscle ring from the mucous membrane, allowing the mucosa to bulge up into this wound. This we believe is going to be a distinct advantage in the treatment of this condition and will serve materially to lower still further the mortality rate. While we cannot but admire the record that Scudder (10) and Richter (9) made with gastro-enterostomy, we are of the opinion that gastro-enterostomy is a far more serious operation than the Rammstedt procedure, and will sooner or later give way to the much simpler operation, which accomplishes the same result with less danger to the patient and which permits of the giving of food and fluids so much sooner, establishing a more speedy convalescence. The Rammstedt operation is accomplished in from 15 to 20 minutes from the beginning of the administration of the anæsthetic until the child is taken from the table. In one of our cases this was accomplished in 10 minutes.

One must, of course, use care to avoid tearing through the mucous membrane. This can readily be done if the separation of the pyloric muscle, after its division, is begun at the stomach side and we proceed gradually toward the duodenum. If, however, a small tear is made it can readily be taken care of by clamping and ligating at this point with a fine silk thread as one would ligate a vessel. A stomach tube should always be passed after the abdomen is opened to allow the air, which the child has swallowed while taking the anæsthetic, to escape from the stomach. As a matter of course we also precede each operation with a gastric lavage. After the operation on the pyloric muscle is completed, the stomach tube is inserted, the stomach inflated with air to determine whether or not any perforation of the mucous membrane has occurred. In this way perforation can be demonstrated and taken care of when it might otherwise be overlooked. Feedings are started as soon as the child awakens from the anæsthetic, which is usually about two hours.

To Downes (12) must be given the credit of demonstrating the efficiency of the Rammstedt operation. His results are most striking, but we also realize that the medical care of these cases after operation is just as important as a successful operation. Often bad judgment in feeding or in changing a

AUTHOR'S CASES

Case	Date	Age	Sex	Duration of Symptoms	Operation	Weight			Stay in Hospital	Results.
						Birth Weight	On Admission	On Discharge		
1 L. L.	12-23-16	6 wks.	Male	4 wks.	Rammstedt	8 lbs.	6 lbs. 4 oz.	6 lbs. 12 oz.	10 days	Cured. At 12 months weight 24 pounds.
2 N. D.	3-18-17	22 days	Male (one of twins)	2 wks.	Rammstedt	8 lbs. 8 oz.	7 lbs. 4 oz.	7 lbs. 8 oz.	7 days	Cured. Gained steadily after operation. At 12 months, weight 24 pounds 8 ounces.
3 M. W.	9-20-17	4 mos.	Female	3 mos.	Rammstedt Accidentally opened duodenum	8 lbs. 12 oz.	8 lbs.	8 lbs. 2 oz.	10 days	Cured. Postoperative convalescence stormy for 4 days; then uneventful; at 10 months, weight 18 pounds.
4 D. H.	10-6-17	6 wks.	Male	3 wks.	Rammstedt	5 lbs. 8 oz.	4 lbs. 8 oz.	5 lbs. 15 oz.	3 weeks	Cured. At 6 months, weight 12 pounds 14 ounces.
5 B. S.	1-19-18	3 days	Female	Since birth	Rammstedt	6 lbs.	5 lbs. 12 oz.	6 lbs. 4 oz.	12 days	Cured. At 3 months. weight 9 pounds.
6 M. O.	3-4-18	6 wks.	Male	3 wks.	No operation	6 lbs. 8 oz.	7 lbs.			Refused to come in hospital. Did not return to Clinic. After 6 weeks vomiting stopped.

feeding may cause a fatality where the operation has been thoroughly successful.

These cases must have *breast milk*, and they must have it in small quantities at the beginning and it must be increased slowly. In our cases we have followed the method adopted at the Babies' Hospital, New York. We start the feeding two hours after the anæsthetic, or when the baby is well awake from the anæsthetic, with 4 cubic centimeters of breast milk and 4 cubic centimeters of barley water every three hours, increasing 4 cubic centimeters of breast milk every other feeding until we get the breast milk up to thirty cubic centimeters and then we give thirty cubic centimeters of breast milk every three hours during the day and every four hours at night. The baby is not allowed to nurse the mother for from 5 to 7 days after operation, and then the baby is weighed before and after nursing to determine the amount he gets. Castor oil is given 24 hours after operation. Practically every case that we have treated has received an ante-operative hypodermoclysis. Some few received hypodermoclysis after the operation. The greatest care is taken not to chill the baby during operation and external heat is applied for a number of hours after operation. Should a diarrhœa follow the operation we would treat it the same as other diarrhœas, with protein milk or protein and breast milk. We must remember that these cases are feeding cases still, and some of them may remain difficult feeding cases, and when the surgeon has finished the operation the baby should be turned over to some one who has some skill in feeding infants. In these cases more than any other the co-operation of the surgeon and the pediatrician is required for success.

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A THEORY ON THE ETIOLOGY OF THE TOXÆMIA OF PREGNANCY WITH OR WITHOUT CONVULSIONS

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MUCH has been written in regard to different methods of treating the complex of symptoms known as the toxæmia of pregnancy with or without convulsions, and many different theories as to the fundamental cause of this condition have been evolved. Many of the profession are still hard at work collecting further data, in an endeavor to locate the fundamental cause. That this cause is not yet satisfactorily established seems generally understood.

Certain clinical facts have recently come to my notice which by their extraordinary nature seem to me to throw some light on this subject. The interpretation of clinical facts can never be a matter of absolute logic on account of the number of factors involved, but the extraordinary nature of certain facts may give a reasonable ground for making a deduction, the truth of which is increased by the extraordinary nature of the facts from which it is made.

The deduction which I have made is that the fundamental cause of toxæmia of pregnancy with or without convulsions is not in the products of conception.

The history of the following case plus subsequent observations in other cases seems to me to raise a strong probability that this statement is true.

Mrs. M. was curetted in December, 1915, for an incomplete miscarriage at 3 months. Following the operation she had some cardiac decompensation and a diagnosis of mitral stenosis was made.

In spite of caution to avoid pregnancy, on August 1, 1916, she told me that she was two weeks overdue. Throughout the pregnant period which followed she was carefully watched and the blood pressure and urine were normal at all examinations. There were no symptoms of toxæmia. Her pulse became progressively more rapid so that by the middle of February she could not move about without dyspnœa and palpitation.

In consultation it was decided to put her to bed and then deliver by cæsarean section. Accordingly on March 14, a cæsarean section was done.

For the next few days the patient did very well. Pulse 110 and no fever.

On the 18th she complained of headache which became so severe on the 19th that it resisted morphia. On the 21st, the patient had 12 convulsions and died on the 22nd. Blood-pressure was normal on entrance to the hospital. On the 19th, it was found to be 180. The bowels had moved two or three times a day since the operation.

Here is a case of postpartum eclampsia with no symptoms of toxæmia appearing until 4 days after delivery, and then reaching its climax 7 days after delivery.

A postpartum eclampsia or toxæmia such as the case cited, implies that the supply of poisonous substance causing the disease increases even after delivery to a point which gives the manifestations of eclampsia and thereby implies that the source of such a poison must be still present in the body after delivery.

It seems absolutely illogical to say that such fulminating symptoms will rise to their height seven days after the cause has been removed.

That the pregnancy itself plays a part in the causation of those symptoms must also be true. We need no more proof of this than what may be called the therapeutic test, that is, by termination of the pregnancy we frequently bring about an almost immediate abatement of symptoms in a large majority of cases. Thus we have two apparently inconsistent facts, the unquestionable evidence that the symptoms are dependent upon the existence of a pregnancy and the evidence that the products of conception are not the primary cause. In solving the problem of the fundamental cause these two facts must be made to agree.

In August, 1916, another case of extraordinary character came under my care and, as this case forms the starting point of my subsequent observations, I will report it in full.

Mrs. E., age 33, born in Massachusetts; married 6 years; no children. The patient's father died of chronic nephritis. Uncle and aunt on father's side died of kidney trouble. Aunt on mother's side ill

with high blood-pressure. (On account of chronic nephritis in the family, the patient has had her urine examined repeatedly throughout her life. All examinations have been negative.)

The patient had had no serious illnesses. Jaundice at 11 years of age. Tonsillitis occasionally. Tonsillectomy 15 years ago.

For years she has noticed that at times her hands and face were slightly swollen, especially in the morning. She has been troubled with facial neuralgia and pains in joints with stiffness, especially in the right arm. These symptoms came on following the placing of a gold crown on a tooth. About one year after the crown was put on, an abscess formed in the gums which discharged pus.

The patient came to my office at the end of the sixth month of pregnancy at which time her blood-pressure was 140. Physical examination was negative except for a small external conjugate of 17½ centimeters. Ten days later she complained of pain in her right elbow and wrist with numbness. The blood-pressure was 140, the urine negative.

One month later the blood-pressure was 155, and both ankles were swollen. The face became slightly puffy, and there was a numbness of right hand except little finger. There was no headache or eye symptoms. The urine was still negative as to albumin and but one granular cast was seen. The patient was immediately put to bed, given magnesium sulphate to bring about watery movements, placed on a meat-, fish-, egg-free diet, and fluids forced to 3 quarts of water a day.

After five days of active treatment the blood-pressure had risen to 180S-100D, albumin appeared in increasing amounts with only occasional casts. With the appearance of casts and the continued high blood-pressure (185) it was decided to start labor.

A Voorhees bag was inserted and the patient kept under morphia during labor. The patient was delivered of a 3 pound male child which died in about 12 hours after birth. Placenta had numerous white areas, no large infarcted areas.

During labor blood-pressure rose to 210, but dropped to 165 following delivery.

Convalescence during the next two weeks was without much disturbance. The first four days were marked with a slight fever 100.5° to normal. The blood-pressure did not fall to normal, however, but rose and fell between 170 and 140.

One month from date of delivery, the urine was clear of albumin and casts, and the blood-pressure was 135. Seven weeks after delivery the blood-pressure rose to 160S-100D with no return of albumin or casts. Patient said she never felt better in her life.

While in the hospital the patient complained of dropping from the back of her nose. This symptom persisted after leaving the hospital.

With the continued elevation in blood-pressure and a perfectly clear urine, this catarrh attracted my attention, thinking that chronic sepsis might explain the elevation of blood-pressure. Consultation with a nose and throat specialist revealed nothing, however.

Six months after delivery, during which time the blood-pressure ranged between 150 and 135, and with an absolutely negative urine, the patient announced that she had at last located some pus. The gold crown tooth had become inflamed and broken a sinus through the gums. This tooth was the upper right bicuspid. An X-ray examination of all her teeth was made and a pus cavity at the base of that tooth and the next molar posterior which seemed to connect with the antrum was found. During 10 weeks of treatment by her dentist the tooth quieted down only to become active again with a return of neuritic pains, puffiness of the lids and the blood-pressure rising steadily to 170S-110D. Urine always negative.

At this point I requested the dentist to remove the tooth entirely which was done on June 20, 1917, and two days later the molar was also removed. There was a marked discharge of foul pus and upon irrigating the cavity, the water came out of the patient's nose.

This undoubtedly explained the source of the catarrh, the neuritic and rheumatic symptoms. These neuritic symptoms during the pregnant period and at the time of the rise of blood-pressure signify the activity of that process although not locally painful.

Why should this human system which had hitherto been free from any evidences of serious disease, fail to perform the functions attending the development of a pregnancy? The repeated negative examinations of her urine throughout her life give good ground to believe that her kidneys had been in good condition. Until this focus of pus was located, her clear bill of health made the occurrence of toxæmia of pregnancy absolutely unreasonable.

Since March 10, 1917, the day on which this patient announced the result of the X-ray findings in her teeth, I have made observations on all cases of toxæmia occurring on my service in obstetrics at the Worcester City Hospital and Memorial Hospital and in my private practice. In a series of 97 cases up to March 1, 1918, I have been able to find evidence of chronic sepsis in the teeth in all cases, without a single exception.

In most of the cases where a reliable history was obtainable it has been possible to find evidence of the activity of these pus pockets just previous to or accompanying the onset of symptoms.

In general the severity of the symptoms of toxæmia may be said to be proportional to the amount of sepsis present.

One of my private cases is such a marked exception to this statement as to warrant reporting. The lack of any symptoms attributable to the teeth during the progress of the case made me believe that the unbroken chain of cases previously observed was to be broken by this case which I report in full.

Mrs. Po. came under my charge at the end of the second month of her second pregnancy.

Past history was negative except for history of her first pregnancy at which time she became infected and was 7 weeks in bed with right femoral phlebitis.

Throughout her pregnancy she had a normal blood-pressure and normal urine. She had occasional symptoms of dizziness and almost fainting spells, but without other signs. These were at first attributed to nervousness as she had been severely punished at the first delivery by a two-hour attempt at forceps delivery *without ether*.

About two weeks before delivery she began to develop signs of hydramnios which increased gradually. At no time during the pregnancy had the fœtal heart been audible and motion, though felt, was very slight. With the development of hydramnios a bad prognosis as to the development of the child was made. The membranes ruptured about two weeks before her date with the escape of a tremendous quantity of liquor.

After the rupture, the fœtal heart was audible in the left lower quadrant, 140. Vertex above the brim but no small parts could be made out.

On arrival at the hospital her blood-pressure was 150. Delivery was normal in about 20 hours from time of rupture of membranes. The child was a typical case of chondrodystrophia fœtalis and after 2 or 3 gasps died. The placenta showed an infarct about 4 to 6 centimeters in diameter. Bleeding was abnormally profuse. Two hours after delivery the blood-pressure was 185 and remained up for 3 hours, dropping to 130 the next morning. The patient slept well but complained of headache in the occipital region and dizzy feeling when awake.

The following night at 3 a.m. she had 5 convulsions coming on during her sleep. Blood-pressure 170. At 8 a.m. and 11:30 a.m. the blood-pressure was 120. At 12:45 p.m. the patient complained of being dizzy and had two more convulsions. The blood-pressure rose to 170 at this time, but was down to 130 within a half hour, and there it remained for the next two weeks, rising only once to 148.

Up to the end of the first two weeks there was not a sign of pus anywhere. Inspection of the teeth was negative except for one pivot tooth in front. There were absolutely no symptoms from the teeth.

On the fourteenth day the patient developed a temperature of 104°, pulse 148 with pain and tenderness in right breast. The breasts had been bound up at the start and the milk had subsided. Two days later a breast abscess, deep against the muscle, was opened and about one ounce of pus evacuated.

As the nipples had not been used, this abscess seemed to be of hæmatogenous origin and this gave me hope. At the end of another two weeks, the breast having nearly healed, she developed pain in the left kidney region with rise of temperature to 102° and pulse 140. Examination of the urine showed pus cells sufficient to warrant the diagnosis of pyelitis. Under treatment with hexamethylenamine this subsided in less than a week.

It is important to note that at the time of the breast abscess and at the time of the pyelitis there was a definite rise in blood-pressure corresponding to temperature curve.

Believing that the breast abscess and pyelitis were evidence of a pus focus somewhere, the teeth were X-rayed completely and two pockets of pus thereby located, one in the pivot tooth and one farther back in the upper jaw.

This case is important as it points out that the absence of local symptoms cannot be depended on to rule out the presence of focal infection.

The fact that in many cases there is evidence of activity in these pus pockets just preceding or associated with the occurrence of symptoms of toxæmia, and the fact that the severity of the symptoms is in general proportional to the amount of chronic sepsis present are evidences which tend to show that there is a relationship between the chronic sepsis and the incidence of the disease.

Can this relationship be explained? I not only believe that the relationship can be satisfactorily explained but also that the explanation throws light upon other than purely obstetrical problems.

Among the many striking facts associated with the development of a normal pregnancy is the marked stimulation of the metabolic processes of the maternal system, as evidenced by the increase in appetite, the increase in weight, and the remarkable sense of well-being. The patient passes through a period which is described by the common statement that "I never felt so well in my life."

That this increase in metabolism throws a definite strain on the woman's organism is a fact of which we have clinical proof.

For example, interpose a pregnancy on a damaged heart and we see clearly that the increase in the functions of the body in order to develop the pregnancy, will so tax a heart which has hitherto been sufficient for the needs of the body, that we often get definite breaks of compensation which cannot be attributed to any other cause than the physiological process going on. Thus we see that pregnancy, itself a perfectly physiological process, can break down the reserve power of one organ to the point of decompensation. If this be true, why can not this same physiological process break down other organs whose reserve may have been weakened by some previous or concurrent process?

Which of all the organs of the body is most consistently linked with this disease known as toxæmia of pregnancy? The kidneys, the main organs of excretion of the waste products of nitrogenous metabolism, give us our most reliable signs of approaching trouble. Not only do the kidneys link themselves with the vital processes of this disease by giving us warning of approach of danger, but they are more strongly linked by the similarity of the symptoms which follow from kidney inefficiency which we know as chronic nephritis, and furthermore by the marked increase in the incidence of the disease where pregnancy is interposed upon an already existing chronic nephritis.

That the waste products of normal physiological metabolism are injurious to the organism of man if retained is surely true. Anuria if continued long enough always results in death. Anuria must primarily cause an increase in the concentration in the blood of the waste products of physiological metabolism.

If they are injurious to the body cells in abnormal concentration, can it be truly said that they are *not* injurious in normal concentration?

It is a fundamental characteristic of all things in this world to wear out. It is not too much to assume that such a process must be present in the human system. It is perfectly reasonable to believe that arteriosclerosis in old age is merely the end-result of a purely physiological process. The blood vessels, being constantly bathed in a fluid containing these harmful excretory products, gradually respond to their injurious effects, resulting in what we know as arteriosclerosis. There is plenty of clinical evidence that, by regulating the diet and activities of a patient suffering from arteriosclerosis, the life of that patient can be prolonged. One of the principal results from controlling these two factors, diet and exercise, is to bring about a reduction in the production of the waste products of the body which must in time make a reduction in the concentration of these products in the blood.

If such a slow, wearing process is tenable at all, it must follow that there is a slow subminimal injury to the kidney epithelium itself.

Normal pregnancy itself without question increases the total of the metabolic products in the body and with this increase of metabolism causes an equal increase in the total quantity of excretory products to be eliminated by the kidney. This increase in quantity must increase the percentage of concentration of those excretory products in the blood and therefore put a greater strain on the kidneys, or in other words, it must use up a part of the reserve power of the kidneys.

The great concern of the kidney as an organ of excretion must be with the percentage of concentration of those excretory products in the blood. The reserve power of the kidney must consist in its ability to continue to excrete those waste products even in abnormal concentration. It must be also true that it is from the blood which is on the edge of the stream, that is, the blood which is in contact with the renal epithelium, through which the process is carried on.

We have therefore a situation during a developing pregnancy in which the kidneys as excretory organs are called upon to excrete a gradually rising tide of metabolic waste products which waste products are injurious to the system if retained. This situation demands that the excretory apparatus of the body should be in its highest state of efficiency.

How does the presence of undrained chronic sepsis affect this situation? We know that persons suffering from acute infection frequent-

ly show a concentrated urine, which not infrequently contains albumin, blood and casts. It is generally agreed that these findings are the result of an inflammatory reaction on the part of the kidneys resulting from the toxins of the acute infection which the kidney is called upon to excrete.

If the toxins of acute infection are an irritant and injury to the kidneys, so the toxins of chronic sepsis which are drained into the blood must damage the excretory functions of the kidney.

It is probable that they are like the metallic poisons, acting as a foreign substance to the physiological processes of the body and, just as we find chronic nephritis developing from chronic metallic poisoning, so we have here in the toxins from chronic infection a perfectly good cause for chronic nephritis.

The fact that chronic nephritis is so common an ailment of the human race proves that the cause must be equally common. The insidious manner in which it develops suggests an equally insidious source.

It is not the purpose of this paper to discuss the causes of chronic nephritis but, in view of the observations which were necessarily made in working up this paper, I am convinced that could we eliminate the chronic sepsis which occurs in connection with the teeth, we could surely eliminate the most potent cause of chronic nephritis.

How do the principles above set forth affect the pregnant woman?

Pregnancy in itself must be a purely physiological process, no part of which is antagonistic to the physiological processes of a normal woman. It is generally so accepted. In a normal woman nature has provided a kidney function which is sufficient to carry on that organism. The kidney reserve power in a normal individual is known to be largely in excess of the needs of that normal individual. It is sufficient in the majority of cases to take care of the extra work which is necessitated by the increase in metabolic products resulting from pregnancy which must be excreted.

When, however, we start with a woman who has an impaired kidney function as evidenced by chronic nephritis, then we begin to get an increase in the incidence of those symptoms which go to make up the entity known as toxæmia of pregnancy. We start with a kidney with reduced reserve power and this might explain the increased incidence of the trouble.

If chronic nephritis occurred as a background, preceding or concurrent with each case of toxæmia of pregnancy or eclampsia, it would be possible to say that the increase in normal metabolic waste products resulting from the pregnancy was sufficient to overcome the reserve power of the kidneys, which reserve power had already been lowered by the chronic nephritis present. But such is not the case. Toxæmia of pregnancy and eclampsia occur in individuals who show no evidence of any previous kidney trouble. This fact tends to show that the kidney reaction is only secondary to the underlying cause.

The important facts to be noted are, however, that the cause of the trouble is not primarily in the kidney, but that the lack of proper kidney function causes an increased incidence, thereby showing the immediate relation between the excretory function of the kidney and the occurrence of the symptoms.

What other evidence have we that this matter of elimination is the crux of the situation? Surely the treatment which has given the best results is the so-called eliminative treatment. Here again is the clinical recognition of the fact that there is a retention of something in the system which, if it can be reduced in amount, brings good results. It is most reasonable to assume, therefore, that this something which may be termed a poison is in the blood stream.

The reaction of the kidneys in this disease of toxæmia of pregnancy is similar to that which occurs when there is a poison or toxin in the blood. The very fact that it is the liver, kidneys, and placenta that are most damaged, as shown by the pathological findings at autopsy, is significant. These three organs may be classed together as the principal organs of the metabolism of the blood. It is also important to note that it is in these three organs that the blood stream is the most sluggish.

It is then fairly clear that we have to do with a poison in the blood stream which is in such concentration that it causes the symptoms which we know as toxæmia of pregnancy. If this concentration can be reduced by increasing the power of the body to eliminate we secure an abatement of symptoms.

The problem which presents itself is, therefore: what is the source of the poison and why is the poison not eliminated?

I have shown that the incidence of toxæmia of pregnancy in the series of cases observed was coincident with a focus of chronic infection. I have raised the point that the toxins of acute infection cause an inflammatory reaction in the kidneys with an inhibition of their excretory functions. I advance the point that the toxins of chronic sepsis are an irritant and an injury to the kidneys and cause a reduction in the reserve power of those kidneys. We have, therefore, in these individuals who have a focus of chronic sepsis a reason why their elimination is not up to normal.

The immediate cause of the syndrome of symptoms known as toxæmia of pregnancy cannot be found in the toxins of chronic sepsis. It seems clear that this cause must have a closer relationship to the pregnant state.

I have tried to show that the case of Mrs. M. is strong evidence that the immediate cause cannot be found in the products of conception.

We know beyond doubt that the normal physiological excretory products of the system are injurious to that system if retained. We also know that there is no other condition in nature where there is such a large quantity of these normal excretory products to be excreted as during a developing pregnancy.

Is it, therefore, a reasonable hypothesis to say that the symptoms of toxæmia of pregnancy with or without convulsions are caused by the retention of the normal physiological waste products of the developing pregnancy, this retention being due to the damaged functional power of the kidneys, which damage has been brought about by the toxins of chronic sepsis in the blood? There is clinical evidence that this hypothesis is true.

It is a most striking coincidence that the symptoms resulting from chronic nephritis are so similar to those which occur in toxæmia of pregnancy and eclampsia that it can be safely said that there are no symptoms of chronic nephritis which do not occur in toxæmia of pregnancy and eclampsia. This great similarity of symptoms in itself implies a common cause.

If we assume that the symptoms of chronic nephritis are due to the retention of normal physiological waste products, that it is these products which stimulate the rise in blood-pressure, that they stimulate the symptoms of headache, blurred vision, œdema, vomiting, and lastly convulsions, and that this retention is due to a lack of eliminative functional power on the part of the kidneys, is not the likeness of the two diseases made clear?

In the case of a chronic nephritic the excretory function of the kidneys is inhibited in the same way as in the case of an eclamptic. The demand made upon the kidney function in the former is, however, very different from that in the latter. The quantity of excretory products which the kidneys are called upon to excrete in normal life during the development of a chronic nephritis is more or less constant and the reserve power of the kidneys does not break down under this constant until the damage has lowered the reserve power to a point where the kidneys can not carry off the normal amount of waste products necessary to maintain life.

The demand made upon the kidney function during a developing pregnancy is not a constant but a gradually increasing strain upon that function. It is therefore an acute process as compared to the development of a chronic nephritis.

The end-results so far as symptoms are concerned resemble each other just as we should expect and it is for this reason that I believe the cause of these symptoms is the retained waste products of physiological metabolism which we know to be injurious if retained.

A vicious circle is established. The toxins of chronic sepsis, by their inhibition of the kidney functions, cause a retention of the normal waste products of the body. These waste products are also injurious to the

excretory function of the kidneys when in abnormal concentration in the blood.

Nature's endeavor to meet this situation is reflected in the rise in blood-pressure. The rise in blood-pressure has been found to be among the earliest evidences of the presence of this disease of toxæmia of pregnancy. Irving states in his review of 5,000 cases at the Boston Lying-in Hospital that the rise in blood-pressure precedes the appearance of albumin twice as often as it follows it.

What is the immediate cause of the rise of blood-pressure? Is it the toxins from chronic sepsis or is it the retention of metabolic waste products,—or is it the combination of the two? It seems to me that the rise in blood-pressure cannot be due solely to the presence of the toxins of sepsis, because there are so many instances where we know that the blood is full of toxins of acute disease without a rise in blood-pressure.

It is therefore probable that the rise of blood-pressure is due to the retained products of metabolic waste either alone or in combination with the toxins of chronic sepsis.

It is generally conceded that the rise in blood-pressure is due to stimulation of the adrenal glands and that this rise in blood-pressure is a conservative process, an endeavor on the part of the system to increase the elimination by bringing more blood to the kidneys in a given space of time.

The rise in blood-pressure arising from stimulation of the adrenals is due to a constriction of the peripheral vessels, that is an increased resistance to the flow of the blood. This increased resistance must raise the diastolic pressure in the arteries provided that the supply of force from the heart remains the same. This increase in the diastolic pressure must put an increased load upon the heart muscle in order to keep up the normal pulse pressure. In fact, unless the heart compensates for this extra load there will be no rise in blood-pressure, as the heart must be the only source of the arterial blood-pressure.

It is at this point that we have the dividing line between two types of toxæmia of pregnancy; the first class being the typical example, where the blood-pressure continues to rise in proportion to the amount of toxæmia present, which rise is due to the compensation of the heart muscle to the demands made upon it. The second class is less common, but a more serious type, in which we find evidences of the severity of the toxæmia out of proportion to the elevation of the blood-pressure. Such cases may be characterized as those with headaches, dizzy spells, blurring of vision, œdema, and albumin and casts in the urine, with only a moderate or no rise in blood-pressure. This second class of cases is clinically well known as the more serious type. The rise in blood-pressure the main object of which is to increase the elimination is what these cases lack. This lack is primarily due to a failure of the heart muscle to respond to the demand made upon it. By failure of the heart to raise the blood-pressure and thus increase the elimination, the toxins increase in concentration in the blood and do more damage to the liver, kidneys, and placenta.

Many cases are reported in the literature of the dental profession as well as of the medical profession which demonstrate the good results obtained in cases of arterial hypertension by removing all foci of infection from the teeth. It has also been recently reported that certain cases of albuminuria have been cured by eliminating chronic sepsis from the teeth. If these reports are true, and I am convinced that they are, we have further evidence to corroborate the above theory.

Once it is admitted that a focus of chronic sepsis can cause arterial hypertension or albuminuria it is then necessary to admit that the coexistence of toxæmia of pregnancy and a focus of chronic sepsis is of the utmost importance, for is it not these two signs occurring in the presence of a pregnancy on which we base our diagnosis?

Is this theory consistent with the pathological findings in the liver and placenta, which are associated with this disease?

The infarct is regarded by many to be the source of the poison which causes the trouble. If we regard the infarct as the result of this poison are not the findings more consistent?

We know that the toxins of sepsis cause an inflammatory reaction in the kidneys. Why

should not this same poison cause an inflammatory reaction in the villous membrane? It should be remembered that this villous membrane is constantly being enlarged throughout pregnancy and that it is on the edge of the placenta that this productive process is going on most rapidly. Every tissue which is in the process of production is in its stage of lowest resistance. It is therefore a tissue which would be more liable to damage from any toxins in the blood. It has been my experience to find most infarcts of any size located on the edge of the placenta and that there is frequently an indentation in the circular circumference of the placenta at this point. This indentation is evidence of the destruction of the villous membrane which prevents its further growth at this point. Is it not reasonable to regard the infarct as an area of villous membrane damaged by toxins in the blood with nature's healing process superimposed?

The central necrosis in the liver found at autopsy is most consistent. Is this not exactly what we should expect to find in view of this theory? The death of the individual represents an acute overwhelming toxæmia which the system has been unable to combat. The liver is known to be the greatest detoxifying organ of the body. If this detoxifying power is overcome it is most natural to expect that that same organ would be most consistently injured.

To return to the infarct. The association of antepartum hæmorrhage with toxæmia of pregnancy has long been recognized. As I have stated above, the injury to the placenta from a toxin in the blood is most liable to occur on its edge. If this damage is sufficient to cause a partial detachment of the placenta at this point, it would certainly result in hæmorrhage.

Here again the theory is consistent with clinical evidence.

If the above theory as to the etiology of toxæmia of pregnancy is correct, it is a logical conclusion that we must have a postpartum toxæmia of pregnancy as well as a postpartum eclampsia.

I will report two typical cases of postpartum toxæmia of pregnancy.

Mrs Pa., a 36-year old primipara, suffered from postpartum eclampsia. On discharge from the hospital she had a blood-pressure of 150 systolic. Five months later she came to me because of shortness of breath, vomiting, headache (severe), and specks before her eyes. She said she had felt perfectly well since discharge from the hospital until about a week ago. Her blood-pressure at this visit was 195-140 and she complained of severe pain in the right epigastrium. While in the office she had a moderate nosebleed. She went directly to the hospital and remained in bed for one week.

Inspection of her mouth showed the following points. Several gold crowns. One lower left molar had inflamed gums. No toothache. On second night in hospital she had severe neuralgia on right side of face and ear with toothache.

At the end of a week her blood-pressure dropped to 150 and the patient felt much relieved. Tenderness in abdomen gone.

X-rays of her teeth were taken by a dentist who was very distinctly one of the nonco-operative kind. He did not take them all and it was only after repeated questions that he admitted that he found anything. The final outcome was the removal of the molar in the lower jaw which the patient said had "an awful foul odor," but the dentist informed me that there was not much the matter with it.

Following the removal of the teeth, the patient had two weeks of considerable discomfort, having two severe attacks of epigastric pain with shortness of breath soon after the extraction. At the end of the two weeks she reported. Her blood-pressure was 160-120. The urine was negative except for light specific gravity 1010. She said she now felt better than before the extraction. Numerous small pustules appeared on her breast and legs following extraction of the tooth.

The X-ray examination is very unsatisfactory in this case, as it is not complete. Although a tooth with abscess was found on the left side, I am convinced that there is still trouble somewhere on the right side in view of the definite neuralgia experienced on the right side of her face while she was under observation in the hospital.

The history of the second case of postpartum toxæmia is as follows:

Mrs. W., age 27; primipara; born in Maryland; married 3 years. Family history negative. The patient had rheumatism when 8 years old. She has had some stomach trouble termed "gastritis." Operated upon June, 1916; dilatation and curettage for sterility.

The patient came under my observation in December, 1916. Her last period was October 15, 1916. Five days before this visit she had a little bleeding which had continued. The patient remained in bed for nearly six weeks because of intermittent bleeding which was accompanied by considerable nausea and vomiting. There was another slight bleeding

spell in March which quieted down in a few days. The blood-pressure and urine remained normal during this period.

From March until the time of delivery nothing abnormal appeared except a rise in blood-pressure in June, 1917, to 145-90 at which time there were no other symptoms except difficulty in sleeping. Forceps delivery; convalescence normal.

Three months after delivery I was called on account of a return of epigastric pain, stiffness of joints and indefinite feeling of lassitude.

Blood-pressure was found to be 145-100. Inspection of teeth revealed nothing except one gold crown. A complete X-ray of the teeth was recommended, and although the patient denied any symptoms from them, five pus cavities were revealed, the largest at the root of the gold crown tooth. Treatment of the teeth has not yet been completed.

I am convinced now that the evidence of chronic sepsis at the roots of five teeth has been established, that the difficulties which she experienced in the early part of her pregnancy, that is, the bleeding and gastric upset, were probably due to the toxins of this chronic sepsis. Note the rise of blood-pressure which occurred in June. Here we have a sufficient rise to suspect a beginning toxæmia.

Assuming that this theory on the etiology of toxæmia of pregnancy is the correct one, what does it offer in the treatment of the disease? Up to the present time I have not endeavored to treat this disease by attacking the foci of sepsis in the teeth, and I have refrained for what I believe is a very good reason.

Suppose a woman develops the signs of approaching toxæmia of pregnancy during or after her seventh month. According to the theory this is a declaration on the part of her system that the excretory function of the kidneys is not equal to the demand. I have not felt justified in having the foci of sepsis interfered with. If the tooth is extracted or dental treatment with a view to draining the tooth is instituted, this treatment will necessarily throw more toxins into the system and may thereby inhibit the functional powe · of the kidneys further, with the result of bringing on convulsions or serious toxæmic symptoms.

This view of the situation has been supported to a certain extent in the postpartum treatment of those cases which I have had the opportunity to watch. In one case (Mrs. Pa. cited above) the patient had two weeks of great discomfort from headaches, severe epigastric pain and nosebleeds with a general feeling of malaise following the pulling of one of her teeth. Another case (Mrs. W. cited above) had her blood-pressure rise to 150-105 from normal, following the pulling of two teeth with pus at the roots.

I do believe, however, that all cases should have dental treatment immediately following the end of the puerperium. By cleaning up these foci of sepsis before another pregnancy we can at least practice the principles of prophylaxis and place the patient in a position where she can enter upon another pregnancy without fear of the return of toxæmia of pregnancy with all its dangers to herself and child which that implies.

There are two very unfortunate features in the treatment of this condition; first, the details of the treatment lie in another's hands, and second, the average dentist does not work with the assistance of X-ray examinations. There is too the great disadvantage that completely to eradicate the sepsis from the teeth, the treatment must last for months, which makes it very expensive.

However, if the truth of this theory can be supported by the observation of others to the extent that it shall be accepted, methods of treatment will undoubtedly be forthcoming.

In conclusion I do not wish to imply that the focus of chronic sepsis must necessarily be found in the teeth. I believe that any focus of chronic sepsis, such as a chronic tonsillar abscess and the like, may bring about the same result. A focus of chronic infection draining toxins into the blood stream is the essential condition.

SUMMARY.

The apparent inconsistency of the clinical evidence that the primary cause of toxæmia of pregnancy with or without convulsions is not in the products of conception and yet the termination of the pregnancy causes an abatement of the symptoms is thus explained.

The immediate cause of the symptoms of the disease is the retention of the normal physiological waste products of the developing pregnancy. The primary cause, or the cause of the retention, is the inhibitory effect of the toxins of chronic sepsis on the excretory functions of the kidneys.

The increased incidence of this disease in those individuals who have a pre-existing chronic nephritis proves the intimate relation between the occurrence of symptoms and the damaged excretory function of the kidneys.

By terminating the pregnancy the main supply of these excretory products is removed. Postpartum eclampsia and postpartum toxæmia of pregnancy are caused by an increase in the inhibition of the functions of the kidney following delivery, due to an increase in the percentage of concentration of the toxins of chronic sepsis in the blood, thereby causing an exhaustion of the remaining excretory reserve power to a point where the retention of the normal metabolic waste products in the system causes the symptoms of eclampsia and toxæmia.

DIAGNOSIS AND TREATMENT OF CHRONIC DUODENAL OBSTRUCTION[1]

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THE impression seems to be general that chronic obstruction of the duodenum is rare and difficult to diagnosticate. A great deal has been written on acute postoperative dilatation, but with a few exceptions the literature of chronic obstruction consists of reports of cases secondary to ulcer.

Lewis Dwight, prior to 1897, made a series of wax casts of the duodenum and in that year reported briefly his findings from a purely anatomical point of view. The casts are still preserved at Harvard and through the courtesy of Dr. Bremner I have had an opportunity to study them.

Only in infants did I observe the G shaped duodenum of uniform caliber, which the anatomies picture. In these cases there was little evidence of the angulation so evident in the adult duodenum. In the adult cases the variation in size and shape was marked. There were, however, certain anatomical markings uniformly present. The first portion lacked the deep striæ observed over the rest of the duodenum, the mucous membrane of this portion apparently being like that of the stomach. At the junction of first and second portions there was a marked constriction in every case.

The junction of the second and third portions was not always clearly defined but in about half the cases a distinct angulation was in evidence and some of the specimens show a constriction at this point.

The transverse portion varied greatly in length and circumference. Most of them showed a distinct groove on the superior and anterior surface caused by the superior mesenteric artery and beyond this an angulation at the junction with the jejunum. In all these casts, the posterior surface of the transverse portion showed a groove due to pressure of the spine alone or spine and aorta together. Some of them showed a fourth ascending portion which was absent in others.

The most important lesson to be learned from this study is that the duodenum is placed at a disadvantage in the matter of drainage and is easily subjected to mechanical interference.

The papers of Anders, Bloodgood, Stavely, Codman and Vanderhoof are worthy of perusal. Bloodgood calls attention to the association of a large prolapsed cæcum and short mesentery with dilatation of the duodenum. Stavely reports what appears to be the first case of primary duodenojejunostomy, performed in 1910. These papers give one the impression that the condition is obscure and the diagnosis impossible unless made by the X-ray or after the abdomen is opened.

It is my belief that the condition is frequently present and the diagnosis can usually be made by the history and physical examination even in cases in which it is not demonstrated by the roentgenologist.

From my private files I have taken the

[1] Read before the Stamford Medical Society, and Ohio County Medical Society, Wheeling, West Virginia.

following partial list: twelve cases treated without operation; one case treated by gastro-enterostomy; two cases treated by gastro-enterostomy plus duodenojejunostomy; three cases treated by operation upon the cæcum and ascending colon; five cases treated by division of adhesions; eighteen cases treated by primary duodenojejunostomy; three cases of viscious circle treated by duodenojejunostomy after gastro-enterostomy.

I am convinced that this condition has been present in many earlier cases, some being relieved by operation or treatment for other conditions, while in others the results have been unsatisfactory from failure to recognize this factor in the production of symptoms.

ETIOLOGY

At the operating table we have learned that the obstruction may involve the first portion of the duodenum only, the first and second portions, or the entire duodenum.

When the first portion only is dilated the junction of the first and second portions is angulated, caused by the duodenum being drawn up close to the liver by contraction of mesenteric bands or by adhesions binding together the first and second portions, or by gastroptosis, the duodenum remaining fixed. In the second group giving dilatation of the first and second portions it has appeared to be the result of adhesions extending from the gall-bladder or hepatic flexure of the colon.

In obstruction of the entire duodenum I have frequently found the condition described by Bloodgood, i. e., a redundant cæcum displaced into the pelvis with a short mesentery at portion of ileum near the cæcum. In this group, I believe, the significant factor has been the dropping of the hepatic flexure which causes a straight pull of the distended bowel from the splenic flexure across the point of union of duodenum with jejunum. The condition may exist without prolapse of the cæcum, and the following causes are suggested.

Duodenojejunal kink from prolapsed cæcum and hepatic flexure, prolapse of transverse colon, adhesions from cholecystites, ulcer, inflammation at duodenojejunal junction; constriction of opening in mesentery through which the duodenum passes, faulty development of the lower thoracic region, gastroptosis with stretching of the attachment of the second portion of duodenum, disease of pancreas.

It is certain that frequently a considerable degree of obstruction exists without symptoms, the condition being found at operation or by X-ray examination.

A study of the clinical cases shows two sets of symptoms: *toxic and mechanical.* In some cases both are present; in others one group only.

Some of the *toxic symptoms* are usually in evidence, i.e., headache, mental depression, lack of strength, disturbed heart action, cold extremities, skin eruptions.

Headache has been most frequently present. It is usually temporal, sometimes occipital and is constant or occurs several hours after meals Often it is associated with nausea and may be relieved by eating.

The mental depression may be very marked. Impairment of vigor is more frequently complained of.

The disturbance of heart action may take the form of tachycardia or bradycardia or simple irregularity of action. These patients are apt to complain of bilious attacks, i. e. headache, nausea and vomiting of bile.

Mechanical symptoms. In obstruction of first portion only, the symptoms are those of partial pyloric obstruction without the special symptoms described below, due to interference with bile drainage.

In obstruction of second and third portions, the mechanical symptoms will vary according to the problem presenting. If the case is one in which interference is due to a prolapsed cæcum dragging on the mesentery, we may find periods of comfort so long as the colon is empty, but with an attack of constipation the drag of the distended cæcum inaugurates an attack. This is, in my estimation, the mechanism of the so-called bilious attack.

The amount of resistance to back pressure offered by the pylorus will modify the symptoms. With a resistant pylorus pain is prominent; with a relaxed pylorus regurgitation or vomiting of bile is predominant.

I have found two distinct points of discomfort: (1) A pain or dull ache just to the left of the median line and slightly above the navel (presumably the duodenojejunal junction). This pain is frequently relieved by deep pressure. (2) Pain located to the right of the median line and above the navel extending up under the liver and through to the back. It may be colic-like (due to peristaltic unrest) or steady and dull (due to distention), often lasting until relieved by vomiting. Frequently the patients obtain relief by deep pressure in the median line of abdomen below the navel (presumably by unlocking the duodenojejunal kink).

Belching without fermentation may be a troublesome symptom. *Vomiting of bile* may follow the attack of pain, apparently the resisting pylorus giving way. In some cases the patient feels something give, the pain subsides and vomiting or regurgitation of bile follows. Often bile works back into the stomach without pain (incompetent pylorus), and is vomited or regurgitated or may be found if the stomach is washed.

PHYSICAL EXAMINATION

Hayes has taught us to recognize dilatation of the duodenum by the physical examination of the abdomen. He writes as follows:

> Dilated duodenum is shown by a marked tympanites in the area behind the right rectus muscle to the right of or posterior to the pylorus and lying between the liver above and the transverse colon below. The dilated duodenum is readily mapped out by the employment of percussion with pressure. Owing to the kinking of the duodenojejunal junction the duodenum is found to be distended with gas, often two or three fingers in diameter. This duodenal inflation is frequently associated with gastric stagnation or retention.
>
> Pressure paradox. In cases showing a dilated duodenum, pressure is made backward and upward for about thirty seconds by the hand placed just below the umbilicus, the patient being in a semirecumbent or reclining position. It might be thought that this would increase the amount of gas present in the duodenum; on the contrary, in the type of case we are considering it will usually result in the undoing of the duodenojejunal kink, permitting the duodenum to empty itself, as shown by a relatively dull percussion note or marked diminution in the size of the tympanitic area. At the same time it is often possible to hear and feel the gas escape as it rushes into the jejunum.

The accuracy of this procedure has been questioned but I wish to place myself on record as indorsing his statements. Not all cases can be recognized in this way at all times, however, since the duodenum may not be distended at time of examination or may be obscured by a distended colon or stomach.

The X-ray reports of duodenal obstruction are lacking in uniformity; involvement of the first portion is generally recognized, but of the entire duodenum less frequently. This is probably due to the fact that the duodenum is in part overlapped by the stomach and is not easily demonstrated except by special technique. The procedures suggested by Quimby which seem to help in this demonstration are to massage the stomach vigorously, forcing the bismuth into duodenum and to hold the stomach up toward the dome of the diaphragm while the picture is being taken. It should be remembered that considerable obstruction may exist without marked dilatation if the pylorus is not resistant and that in the type of kink at duodenojejunal junction due to prolapsed cæcum and hepatic flexure, a preliminary cathartic may result in a failure to demonstrate the condition.

It is my custom to inspect the duodenum in all cases of operation upon the digestive tract, and it is my belief that the duodenum should be regarded with suspicion if, when the transverse colon is lifted up, it can be seen bulging through the lower layer of the mesocolon.

TREATMENT

The majority of cases do not require surgery. They are amenable to the treatment given for enteroptosis or intestinal stasis: abdominal support, sleeping with foot of bed elevated, resting after meals in recumbent position (bed elevated), abdominal massage, colon irrigations, duodenal irrigations, mineral oil, cathartics, rest cure combined with forced feeding.

The abdominal support should be applied with a view to lifting up the transverse colon and so liberating the kink. The type of support will be like that for gastroptosis, varying somewhat according to shape of abdomen.

Fig. 1. Wax cast. Duodenum of an infant.

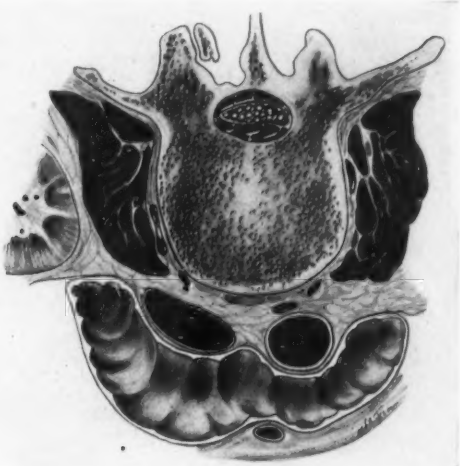

Fig. 2. Frozen section of the human body at the level of transverse portion of the duodenum showing the relation of same to the vertebræ, aorta, and vena cava posteriorly and superior mesenteric artery anteriorly. Note the narrowing of caliber of the duodenum where it passes between the aorta and the superior mesenteric artery.

For the thin retracted abdomen the Curtis-Lane supporter is the most satisfactory while the pendulous protuberent abdomen can be held up by any belt or binder that produces its maximum pressure just above the pubes and iliac crest. For temporary support the adhesive plaster belt (Achilles Rose) will be found very useful. Sleeping with the foot of the bed elevated 8 to 12 inches, is an important therapeutic measure.

By this procedure the drag of prolapsed intestine ceases and the duodenum has an opportunity to empty completely and thus to minimize the infection and irritation.

Resting after meals in the same position is helpful for the same reasons.

In applying abdominal massage the object is to empty the cæcum and ascending colon and unlock the kink. I instruct the patients to press the abdomen backward and upward below the navel with the left hand while with the right hand pressure downward is exerted over the duodenum. For the colon, pressure is exerted upward on right side, transversely at level of navel and downward on the left. A massage ball weighing six or eight pounds will be a great aid in carrying out this treatment successfully.

The rest cure and forced feeding checks the duodenal irritation and infection and diminishes pressure on the duodenum by increasing the amount of adipose tissue in the abdomen. Codman has pointed out that fat people have less pressure on the duodenum than thin people, for fat in the mesentery distributes the pressure, while in thin people the main trunk of the superior mesenteric artery presses the duodenum directly against the bodies of the vertebra.

Duodenal irrigations furnish a means of combating the duodenal infection and irritation, and at the same time help to control the general intestinal toxæmia.

SURGICAL TREATMENT

The surgical procedure will vary with the cause and degree of obstruction.

In obstruction of the first portion only, dividing the adhesions transversely and suturing longitudinally, so as to drop the duodenum, may be indicated, or if stomach is prolapsed the shortening of the gastrohepatic omentum by Beyea's operation, relieves the obstruction. In obstruction of the second portion it is usually a problem of treating adhesions.

In involvement of the entire duodenum, if not too far advanced and plainly secondary to trouble with the cæcum and ascending

Fig. 3. Fig. 4. Fig. 5.

Fig. 3. Wax cast. Duodenum of a fourteen-year-old child. This duodenum appears to be normal in size and shape. The aorta and superior mesenteric artery are *in situ*.

Fig. 4. Same case. Posterior view, aorta *in situ*.

Fig. 5. Same case taken in horizontal position. This view is shown particularly to demonstrate the relation of the transverse portion to the aorta and superior mesenteric artery. Note the groove to the left of the aorta, presumably for the vena cava.

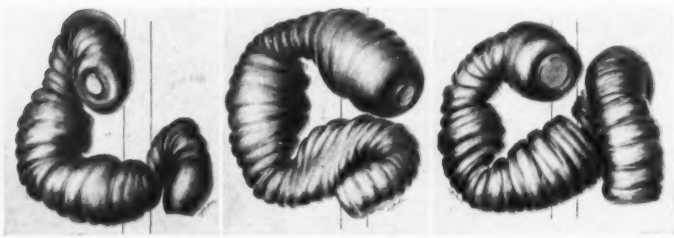

Fig. 6. Fig. 7. Fig. 8.

Fig. 6. Adult duodenum. Showing acute angle at junction of the first and second portions and constriction in the third portion, probably caused by the superior mesenteric artery. Note the acute angle at the junction with the jejunum.

Fig. 7. Adult duodenum. Showing the narrowing at the junction of the first and second and second and third portions. The fourth ascending portion is absent.

Fig. 8. Adult duodenum. Note the deep notch caused by superior mesenteric artery on the superior and anterior surface of the transverse portion.

colon, I have been content to relieve the cause by right sided resection of the colon or plication and anchoring of the same, by supporting the stomach and transverse colon (operations of Beyea and Coffey), or by division of adhesions.

Gastro-enterostomy has been performed, but with a better understanding of the condition, I consider the procedure obsolete in spite of the fact that the case in which I used the method was benefited. When dilatation is marked, the operation of choice, either alone or accompanied with other indicated procedure, is duodenojejunostomy.

In my series there has been no mortality and in every case there has been either improvement or complete relief of symptoms although sufficient time has not yet elapsed to speak definitely of end-results.

The procedure is only a little more difficult than gastro-enterostomy; the technique is much the same. The point of approach is through the transverse mesocolon to the right of the vertebral column. The duodenum can be easily mobilized by blunt dissection, but this is seldom necessary since the dilatation causes it easily to present at point of operation. The convalescence is usually uneventful.

The following cases are reported briefly as examples of the varying problems which present:

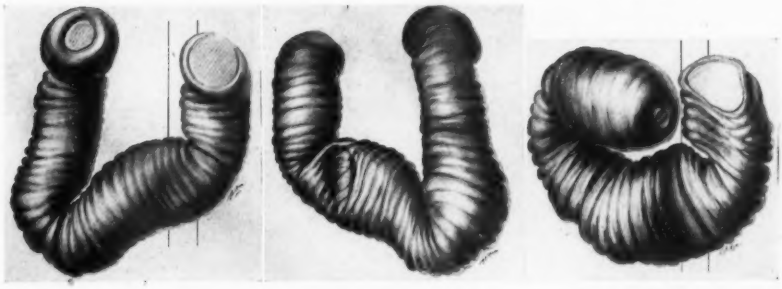

Fig. 9. Fig. 10. Fig. 11.

Fig. 9. Adult duodenum. Showing a dropping of the angle at the second and third portions and an unusually long fourth or ascending portion.

Fig. 10. Under surface (Fig. 9) showing vertical groove caused by aorta. This is present in every case. It may be artificial due to injection of the aorta, but is suggestive as a possible point of pressure.

Fig. 11. Adult duodenum. Showing dilatation of the first, second, and third portions, apparently due to exaggeration of the superior mesenteric groove.

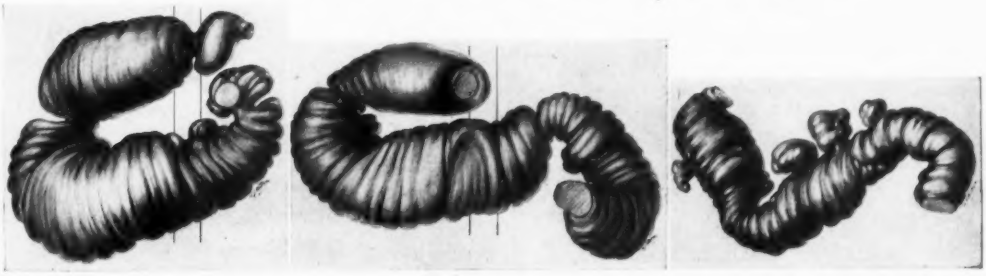

Fig. 12. Fig. 13. Fig. 14.

Fig. 12. Adult duodenum. The first point of constriction is the pyloric ring. The first portion of the duodenum shows marked dilatation due to constriction at the junction to the first and second portions. Second and third portions are dilated, due to constriction at the extreme left of the third portion. The cause of this is not clear, as it is beyond the notch made by the superior mesenteric artery. Probably the angulation at the junction with the jejunum is responsible.

Fig. 13. Adult duodenum. An unusual case; the second third and fourth portions are continuous, extending to the left of the aorta farther than usual.

Fig. 14. Adult duodenum. Interesting because of its peculiar shape, but particularly because of diverticula.

CASE 1. T. J. L., male, age 30. Present illness commenced five years ago. The patient had violent epigastric pain one-half hour after meals; duration short; sometimes a second attack one and one-half hours after meals. Often wakes up with pain from 11 p.m. to 1 a.m. Sometimes eating gives relief.

Examination shows tenderness to pressure over the epigastrium and at point to left and slightly above umbilicus and at hepatic flexure. The duodenum is apparently dilated but this was not demonstrated with certainty. No blood was found by any of the clinical methods.

The X-ray disclosed ulcer and adhesions of duodenum. An operation was performed for duodenal ulcer.

Pathology. A small indurated ulcer was found on the duodenal side of the pylorus; the pyloric ring being partially occluded. The duodenum was considerably dilated being visible three fingers' breadth below the transverse mesocolon when the colon was drawn out of the wound. The jejunum was fastened to the under surface of the mesocolon by a long ligament of Trietz.

Operation. Posterior gastro-enterostomy and duodenojejunostomy. The latter procedure was undertaken with the feeling that the dilated duodenum would predispose to a viscious circle unless it was drained. Convalescence was uneventful, and cure appears to be complete.

CASE 2. M. B., female, age 21. For six months the patient has complained almost daily of colic in upper abdomen to right of navel, extending up under liver and through to back. The pain has no relation to the taking of food but is worse when patient is constipated. Physical examination shows cæcum movable and distended with gas. Duodenum dilated on percussion; upward pressure below trans-

Fig. 15.

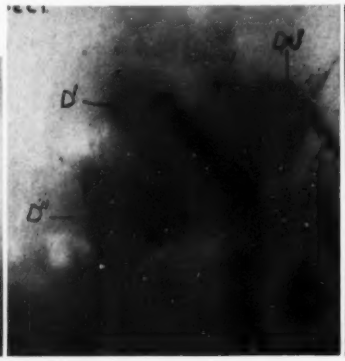

Fig. 16.

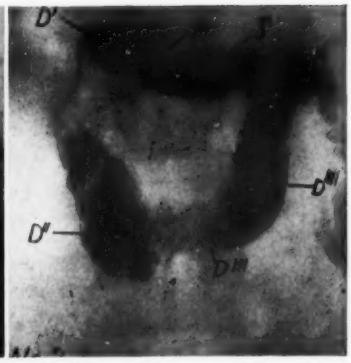

Fig. 17.

Fig. 15. M. B., Case 2. Taken after the injection and partial evacuation of an opaque enema, followed by the administration of an opaque meal, after a portion of the meal has been forced by manipulation into the duodenum. *S*, stomach; *P*, pylorus; *D''*, *D'''*, duodenum; *HF*, hepatic flexure; *AC*, ascending colon; *C*, cæcum. The white line of arrows indicates the direction of the line of traction when the patient is in the erect position and the cæcum is down.

Fig. 16. Case of W. A. K. Taken after the administration of an opaque meal. A portion of the stomach contents was discharged into the duodenum by manipulation with the operator's hands. *S*, stomach; *D'*, first portion of the duodenum; *D''* and *D''''*, second and fourth portions of the duodenum; *DJ*, juncture of the duodenum with the jejunum; *J*, first portion of the jejunum.

Fig. 17. Case of W. A. K. Same case as Fig. 16, with stomach pushed upward by pressure of the hand, exposing a large and dilated duodenum; this duodenum shows four distinct portions. *S*, stomach; *P*, pylorus; *D'*, first portion of the duodenum; *D''*, second portion of the duodenum; D''', third portion of the duodenum; *D''''*, fourth portion of the duodenum. (This case is not reported in the text. Symptoms are stubborn constipation; recurring headaches; pain suggesting duodenal ulcer.)

verse colon liberates gas from duodenum. X-ray examination shows prolapsed cæcum and hepatic flexure and marked dilatation of the duodenum due to obstruction near its junction with the jejunum.

Treatment. A Rose belt was applied and later a combination corset and belt. The patient sleeps with the foot of the bed elevated, duodenal irrigations are given, and mineral oil, digestive ferments, and constipation diet prescribed.

Result. Immediate relief of symptoms. There is no pain while the patient wears the belt but pain returned when the belt was removed. The patient has gained in weight.

This is offered as a type of case responding to medical treatment. The absence of vomiting and bile regurgitation indicates that the pylorus functionates normally.

Case 3. Mrs. B. B., age 47, had suffered from digestive troubles for 2½ years. Two operations had been performed, hysterectomy and gall-bladder drainage, without improvement in digestive symptoms. She complains of hyperæsthesia of the stomach, œsophagus and tongue.

Every week or two she vomits large quantities of bile and in the interim frequently regurgitates it. There is no pain but a very sore feeling in the upper abdomen. She is generally weak. Examination shows a slight resistance over the upper part of right rectus. The duodenum is moderately dilated.

Lavage of fasting stomach shows bile constantly present. X-ray report suggests duodenal ulcer but makes no suggestion of duodenal dilatation.

Clinical diagnosis: duodenal obstruction with moderate dilatation, pylorus incompetent or non-resistant.

Operation, December 5. Pathology (no ulcer demonstrated). Adhesions at hepatic flexure of colon involving gall-bladder and duodenum, the latter dilated extending for three fingers' breadth below attachment of transverse colon; pylorus dilated. The adhesions were divided; duodeno-jejunostomy performed.

Result. The patient has ceased to vomit and regurgitate bile, and the soreness in the upper abdomen has disappeared. The hyperæsthesia has improved, the appetite has improved, and she is gaining weight.

This is the type of duodenal obstruction with incompetent pylorus shown by regurgitation of large quantities of bile without pain. The incompetent pylorus may account for failure of X-ray to demonstrate the condition.

Case 4. E. F. G., male, age 25, commenced three years ago, to suffer attacks of pain with intervals of good health. Two and one-half hours after meals he has severe epigastric pain, relieved by forced vomiting. The vomitus is first sour and later

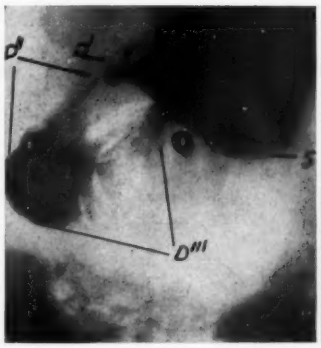

Fig. 18.

Fig. 19.

Fig. 20.

Fig. 18. Case of Mrs. W. Stomach, marked *S*, is pushed upward by hand of the operator; this exposes the contents of the duodenum, marked *D*. The pressure of the hand also displaces the duodenum slightly to the right.

Fig. 19. Case of Mrs. W. Stomach and duodenum in normal position with patient erect. The stomach contents are exhibited as a pool, of which the upper margin is marked *X*. The contents of the duodenum, *D*, form a pool at a slightly lower level, the upper margin of which is marked *Y*. It extends below and behind the greater curvature of the stomach.

Fig. 20. Case of Mrs. W. After administration of enema, exhibits the low position of the cæcum, marked *C*, and the drop of the hepatic flexure, marked *HF*, predisposing to duodenal obstruction. (Figs. 18, 19, and 20 refer to Case 5 reported above.)

bitter. There has been no retention vomiting. Constipation is marked. He has lost 20 pounds.

Examination. The cæcum is dilated, and there is diminished resistance in the right iliac fossa. The stomach is slightly ptosed. There is moderate tenderness in the region of the pylorus. The duodenum is dilated. The stomach contains hydrochloric acid in excess and empties slowly after motor meal, fasting stomach empty. There is occult blood in the fæces, and repeated thread tests show blood stain on duodenal portion of thread. X-ray examination shows penetrating ulcer in first portion of duodenum.

Clinical diagnosis: duodenal ulcer; dilated duodenum. *Operation, October 4. Pathology.* The cæcum is dilated and adherent to the abdominal wall. There is a small indurated duodenal ulcer, just beyond the pylorus. The pylorus is not obstructed. The duodenum is very much dilated, apparently due to inflammatory thickening and narrowing of jejunum.

Duodenojejunostomy was performed since in my judgment the duodenal obstruction was responsible for the ulceration. (Had gastro-enterostomy been performed it would have been necessary to do a pyloric exclusion and the obstruction of the duodenum would have remained).

Recovery was uneventful and complete.

So far as I can learn this is the first recorded case of duodenojejunostomy for duodenal ulcer.

CASE 5. Mrs. H. W. W., age 39. Three years ago the patient had an operation for appendicitis and floating kidney. The symptoms were relieved for two months. Following this she had a series of attacks described as follows:

First attack: Woke up at night with severe pain across the upper abdomen extending up under the sternum. The pain was so severe that she thought she would go insane. Temperature was subnormal.

Second attack: Onset after swimming preceded by three or four days of depression and constipation. Severe pain in same location but not cramp-like. She felt faint and her palor was marked. The pain was constant for a month. No vomiting; temperature was subnormal.

The third attack followed overexertion; it was cramp-like, with vomiting, and lasted two weeks, with temperature normal. Following onset she had a dull pain and soreness through the right side of the upper abdomen.

Fourth attack came on a week ago following a cold, sudden violent cramp-like pain, in the same location. There was no vomiting or faintness. The pain comes about two hours after breakfast.

This last attack continues; she can feel and hear gas moving about causing distention of upper abdomen. She wants to eructate gas but cannot. The symptoms increase as the day advances and are not affected by food. The symptoms gradually subside after retiring but keep her from sleeping in the early part of the night.

Constipation has been constant and stubborn for eighteen years but suddenly became much worse after second attack described above. Vomiting on the few occasions on which it has occurred shows only a little bile. Mental depression is marked.

Examination. The abdominal walls are relaxed. There is diminished resistance in the right iliac fossa. Gas can be heard gurgling and splashing in the cæcum. The stomach extends from the seventh rib to three fingers' breadth below navel. The dilated duodenum can be easily demonstrated by deep percussion; pressure paradox present.

The X-ray shows adhesions involving the terminal portion of the duodenum obstructing this structure when the patient is erect, and causing dilatation of duodenum; ptosis of cæcum; and bands constricting the ascending colon.

Clinical diagnosis. Prolapsed and dilated cæcum, dilated duodenum due to duodenojejunal kink.

Operation February 6. Pathology. Cæcum markedly dilated and prolapsed into pelvis. Hepatic flexure had given way completely so that traction on cæcum caused a direct pull from splenic flexure across the mesentery resulting in pressure at duodenojejunal junction. The duodenum was markedly dilated, the lower border of transverse portion protruding through the mesentery four fingers' breadth below the transverse colon when the latter was lifted out of the abdomen. There was a long ligament of Trietz.

A longitudinal plication of the cæcum and ascending colon, restoration of hepatic flexure and anchoring of cæcum to posterior abdominal wall—duodeno-jejunostomy—were performed.

Result. Convalescence was uneventful. The bowels are moving regularly, duodenal symptoms have entirely disappeared, and the patient is gaining in weight and strength.

This case seems to be identical with those described by Bloodgood which are due to prolapsed cæcum and ascending colon, causing a kink by dragging on the mesenteric vessels. The pylorus is functionating which accounts for the absence of bile in the stomach and the severity of the pain. Note that she describes both types of pain, i. e. dull steady, due to distention and colic-like due to peristaltic unrest.

CONCLUSIONS

Chronic duodenal obstruction frequently occurs, sometimes as part of a general intestinal stasis but also independently. The diagnosis can usually be made from the history and physical examination, and may be confirmed by an X-ray examination, when special technique is employed. An X-ray examination often fails to demonstrate it even when present to a marked degree.

A majority of the cases are amenable to medical treatment. Those not responding can be cured by a surgical procedure which will vary according to the etiology of the case, dividing adhesions or shortening the gastrohepatic omentum, for obstruction of first portion; dividing adhesions for obstruction of second portion. Duodenojejunostomy usually meets the indications for obstruction of the third portion or some operation on the cæcum and ascending colon when the condition is plainly secondary to a drag of the prolapsed bowel and dilatation is not excessive.

The following suggestions are offered:

Acute postoperative dilatation of the duodenum is usually preceded by a chronic condition and may be prevented by correcting the latter. Viscious circle after gastro-enterostomy is due to duodenal obstruction already present or produced by the operation.

In performing gastro-enterostomy, if the duodenum is dilated, a duodenojejunostomy should supplement the procedure. Many so-called billious attacks may be caused by obstruction of the duodenum, following constipation and the drag of a prolapsed cæcum. Chronic duodenal obstruction probably predisposes to duodenal ulcer. In operating for duodenal ulcer when the pylorus is not obstructed and the duodenum is dilated, duodenojejunostomy is the proper surgical procedure.

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DEPARTMENT OF TECHNIQUE

INFECTION OF A FUSED KIDNEY WITH DUPLICATION OF THE LEFT RENAL PELVIS[1]

By LEO BUERGER, M.D., F.A.C.S., New York

IN recounting the history and clinical course of a very interesting case of renal infection, occurring in a kidney with a double pelvis, it is my purpose to discuss some interesting points in the diagnosis of surgical renal disease; and also, to bring to your notice the importance of a thorough knowledge of the existence of renal anomalies, a study of which may aid both in making exact anatomical diagnoses and in the selection of subsequent operative intervention.

The frequency of the incidence of renal anomalies is well known to the urologist. Not enough, however, has been written concerning the occurrence of infections in anomalous kidneys to acquaint the surgeon with the importance of an accurate diagnostic exploration of the function of the anomalous as well as of the sister organ, for the technique of nephrectomy, if it becomes necessary, may be more safely carried out, and the indications for operative intervention more accurately planned, if such precise knowledge is at the surgeon's disposal.

In presenting below a case of duplication of the renal pelvis with duplication of the ureter complicated by calculi and infection, I feel fortunate in being able to discuss clinical manifestations, and cystoscopic and X-ray findings that should prove instructive and interesting, both from a pathological and diagnostic viewpoint.

Above all, the case to be analyzed will emphasize the value of the combined roentgenographic and cystoscopic methods as a reliable and almost necessary prelude to the operation of nephrectomy, when such is indicated for severe infection of one-half of a kidney with a double pelvis.

Large vesical calculus, cystitis, duplication of the ureter and pelvis of the left kidney, pyelitis, pyelonephritis, multiple renal abscesses, perinephritis, calculi in the pelvis of the upper portion of the left kidney with a second normal ureter and corresponding pelvis occupying the lower pole.

M. N., age 38, male, consulted me on December 28, 1917, with the complaint that he had had urinary symptoms for about 2 years, there being a distinct diminution in the size of the urinary stream during that period, with one attack of retention of urine. Two years ago he was told that he had a urethral stricture which required dilatation, this method of treatment having been regularly given for some time, apparently without relief. During a six weeks' period of such treatment, there were occasional attacks of chills and fever, frequency of urination, nocturia, and sticking pains in the left hypochondrium, radiating down into the left iliac fossa. Altogether he seemed to have suffered for about three months after his symptoms began two years ago. The symptoms then gradually subsided and the urgency, and nocturia disappeared so that he seemed to feel quite well.

About four months previously, in September, 1917, he again noticed a diminution in the size of the urinary stream, a decided increase in urinary frequency—voiding bloody urine twice a night—and with cutting pain in the bladder region and tip of the penis during the entire act of micturition.

In short, he presented a history of stricture of the urethra, with one attack of retention two years ago, complicated by chills and fever during the period of dilatation with sounds, and evidences pointing to infection of the left kidney; then again four months ago a return of symptoms, at which time he sought the advice of a physician.

X-ray examination revealed a vesical calculus which, on some of the plates had a spherical outline, (2⅓ inches in diameter), but in a second set of plates, taken December 29, 1917, had an elliptical shape (2⅝ x1½ inches in diameter—Fig. 1).

In the region of the left renal area, over the eleventh and twelfth ribs, there was an irregular, sausage- or kidney-shaped shadow suggesting the presence of more than one calculus, and measuring 1¾ inches in length by ¾ inches in width. The renal shadow indicated a considerably enlarged organ.

[1] A clinical lecture on "Renal Infection" at the New York Polyclinic Hospital and Medical School, March, 1918.

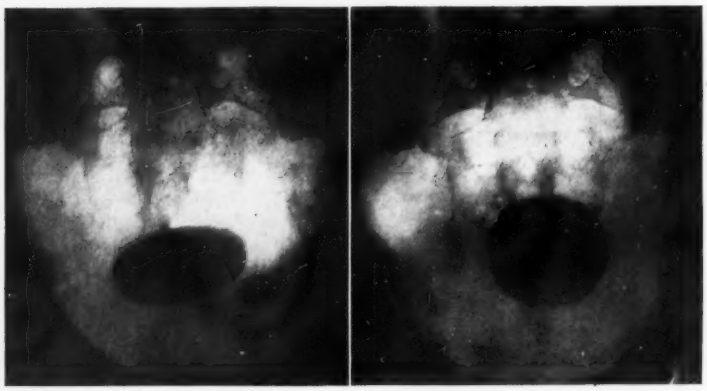

Fig. 1. Roentgenogram of large vesical calculus as it appeared on two different occasions.

In brief, the X-ray examination demonstrated a very large calculus in the bladder, and one or more calculi in the *upper* portion of an enlarged left kidney.

Cystoscopic examination on December 28, 1917, showed a large white calculus of the phosphatic type in the bladder, the ureters coming into view with considerable difficulty. It was possible, however, to push aside the calculus with the beak of the instrument, so as to bring into view the right and what was at the time supposed to be the only *left* ureter, both of which were easily catheterized. Indigocarmine was excreted by the left kidney in 25 minutes, in rather diminished concentration, the specimens being very cloudy; the function of the right kidney was much more active, indigocarmine appearing in good concentration within a period of 20 minutes.

The report of the examination of the separated urinary specimens was the following: right kidney—slightly turbid, urea 1.4, microscopic, few white and red blood; left—very turbid, numerous pus cells, and red blood cells, urea .9 per cent; bladder—turbid, acid, albumin-positive, sugar-negative, with numerous red blood cells on microscopic examination.

The prostate was not enlarged per rectum. Abdominal examination revealed no tenderness in the region of the left kidney, and this organ was not distinctly palpable.

The diagnosis, therefore, was cystitis, a large calculus in the bladder, a calculus or calculi in the left kidney with infection of the left kidney, impaired function of the left kidney, and a fairly healthy organ on the right side.

The operative indications, it seemed to me, were to remove the large calculus from the bladder first, because it was evidently causing the patient so much distress and so much spasm that it was a decided factor in influencing the development of an ascending infection of the kidneys. That it had doubtless been a factor in the infection of the left kidney could be assumed with a fair degree of probability, and it was the fear of the involvement of the right kidney which led me to advise the less serious operation, the removal of the calculus from the bladder, as a first step.

Suprapubic cystotomy. On January 10, 1918, I removed a large flat elliptical stone, measuring 2⅝ inches in length, by way of the suprapubic route, under gas-oxygen anæsthesia, the opening in the bladder being tightly closed with catgut sutures, except for the exit of a small tube through which bladder irrigations could be carried out.

Postoperative course. After suprapubic cystotomy the patient improved remarkably, the general condition at once showing evident signs of amelioration, the temperature being practically normal until the fourteenth day, when there was a sudden rise of temperature somewhat above 102°, general malaise, headache, without, however, any focalizing symptoms. The temperature remained high between 102° and 103° for two to three days, and gradually subsided. During the fourth week after the cystotomy, there was again a rise of temperature up to 103°, the temperature remaining high for three days, and then again gradually coming down to normal.

Although local tenderness in the left kidney region was absent, and spontaneous pain was absent, it appeared most likely that infection of the left kidney was the cause of the temperature and of the distinct impairment of the general condition. No other cause for the rise of temperature could be found.

Exploration of the left kidney was, therefore, advised, which the patient, however, refused, preferring to go home "in order to build up."

The suprapubic wound healed promptly after the removal of the drainage tubes, and the patient left

the hospital with practically no disturbances of micturition, but showing the distinct signs of severe attacks of pyelonephritis. He did not appear strong and healthy, and recurrences of attacks of pyelonephritis were considered extremely likely, and, in fact, were to be expected.

On February 25, 1917, he again came to the office for an opinion, having noticed that he did not "build up," but had become progressively weaker. He was referred to the Mt. Sinai Hospital, for a thorough investigation of his urologic status.

The patient was admitted to the Mt. Sinai Hospital on February 27, with a temperature of 101°, no renal tenderness, a haggard look, and urine containing a fairly large amount of pus. It was again a question as to whether the temperature was due to the infection of the left kidney without local manifestations, or whether some intercurrent or other infection, such as tuberculosis, was present.

On February 28, 1918, another cystoscopic examination was performed to determine whether we were dealing with retention of purulent urine in the kidney or not. At this time it was easy to obtain a perfectly good view of the bladder, because the stone had been removed, and the mucous membrane was found almost normal except for some congestion. It was with surprise, that *two ureters were discovered* on the left side, the upper or posterior one doubtlessly having been covered up by the large calculus at our previous cystoscopic examination. All three ureters were catheterized, specimens being obtained from the right kidney, and from the upper or posterior and lower or anterior ureteral orifices on the left side. A roentgenogram with two shadowgraph catheters, one in each left ureter was then taken, giving the picture seen in Figure 2. The urinary report was as follows:

	RIGHT	LEFT UPPER	LEFT LOWER
Reaction	Acid	Acid	Acid
Albumin	Trace	Trace	Trace
Urea	1.1 per cent	1.4 per cent	0.7 per cent
Microscopical	Few epithelial cells. Few red blood cells No pus cells Few hyaline casts	Few epithelial cells Few red blood cells No pus cells Few hyaline casts	Few epithelial cells Few red blood cells Many pus cells Few hyaline casts
Culture	Sterile	Bacillus coli communior	Bacillus coli communior.

To summarize, we have a fairly normal functionating right kidney with urine containing a trace of albumin; a left kidney containing two pelves, the lower pelvis corresponding to the upper ureter, presumably normal except for the presence of bacillus coli communior in culture and an upper pelvis evidently infected, with urine containing many pus cells, diminished urea output, and infected with bacillus coli communior.

Fig. 2. Two shadowgraph catheters, one entering each pelvis; calculi in upper pelvis.

Desirous of studying the relationship of the two left ureters to the composite left renal mass, two shadowgraph catheters were placed into the two left ureters on February 28, after the urine had been collected, and a plate taken.

On this X-ray plate the course of the two ureters was well outlined, their paths overlapping just below the pelvic brim, and again crossing or being superimposed at about the level of the fourth lumbar vertebra. The relationship of the calculi to the two ureters could also be deduced from these two plates, it being readily seen that they occupied the upper pelvis and the ureteropelvic junction. From these plates, too, the well-known fact that the upper or posterior ureter usually enters the lower pole, whereas the lower or anterior ureteral orifice leads to the upper pole, was found to be substantiated.

On February 28, at about the time that the cystoscopy was done, the temperature had already risen to 103,° and at 4 p. m. was 104.2.° The palpation of the left hypochondrium and left lumbar region gave evidence of an enlargement of the kidney without any local tenderness.

The temperature remained fluctuating between 102° and 103.8° until March 2, when it gradually came down to 102 and on March 3, did not rise above 99.2.°

On March 4, the temperature was again 100°, and by this time we were fairly certain from our investigations that no other focus was responsible for the temperature.

Thus, we were dealing with a man who had had recurrent attacks of pyelonephritis in a kidney with a double pelvis, the lower portion of which was evidently healthy, the other or upper portion harboring one or two calculi, and the seat of an extensive pyelonephritis.

Diagnostic conclusions. In a man who had had a large vesical calculus, and in whom the X-ray findings indicated the presence of a fair-sized calculus in the left kidney, the clinical course as well as the cystoscopic findings, pointed to severe infection of at least the upper half of the left kidney, the lower pelvis being uninvolved. The insidious nature of the process as evidenced by the absence of local pain, renal colic, or local tenderness, the presence of attacks of fever with general symptoms rather than localizing phenomena, made the interpretation of the clinical course and the surgical indications somewhat difficult. However, from a consideration of the findings, it was possible to make the following deductions regarding the anatomical lesions present.

Thus, we surmised that the upper portion of the kidney was the seat of an inflammatory process with multiple abscesses, or at least extensive pyelonephritis, and suppurative areas in the parenchyma; and furthermore, because of the long history, and the absence of a true pyonephrosis (as indicated by cystoscopic findings), and the absence of pain and tenderness, we were in all probability dealing with an inflamed kidney, whose exterior was enveloped in markedly thickened perirenal adipose tissue, that is, a kidney surrounded by enormous fat production, and enveloped as it were, or encased in a mass of inflammatory tissue.

The operative findings corroborated these diagnostic inferences in revealing a kidney that corresponded almost exactly to that which we had expected to find.

Operation, March 5, 1918. Through the usual Albarran oblique incision, the left kidney was exposed, found considerably enlarged, extremely adherent, the upper two-thirds being encased in a large amount of hard, indurated, inflammatory fat, making the separation from the parietes and the peritoneum difficult. The lower pole of the kidney however, appeared to be normal. The two ureters were exposed with little difficulty, the lower one being normal, the upper one thickened, about the diameter of the small finger. The hilus of the kidney as well as the upper pole seemed to be particularly adherent and surrounded by large masses of œdematous and inflammatory fat, through which, however, a calculus in the upper pelvis could be palpated. After the upper two-thirds of the kidney had been freed, and the upper ureter cut across, it became apparent that the lower pole was held by an isthmus of renal tissue, which apparently crossed the lumbar vertebral column. When traction was made upon it, the fusion between the lower pole of this, and its sister organ could be easily demonstrated, the connection being present in the form of a band of renal tissue, about one and one-half inches in diameter.

The isthmus was then divided between clamps and sutured with catgut, the lower normal ureter cut through, and the kidney removed.

Pathological specimen. The kidney is almost twice the normal size, its upper two-thirds being enveloped in a mass of œdematous, hard fat, varying in thickness from 3 millimeters to 1 centimeter, being most markedly developed at the upper pole (Fig. 3). Occupying about the center of the hilus is the upper pelvis, also encased in a large amount of inflammatory fat, the ureteropelvic junction and the pelvis just above it protruding by reason of the presence of a calculus in the upper pelvis. The upper ureter is very much thickened and inflamed. Its walls are at least four times the normal size. That portion of the cortex of the upper part of the kidney that is shining through the capsule is evidently pale, whereas, the parenchyma at the lower pole has almost a normal appearance.

Somewhere between two-thirds and three-fourths of the renal tissue appears to be diseased from a mere surface inspection, while about one-fourth, or the lower pole, appears to be normal.

On section (Fig. 4) it is evident that the upper three-fourths of the kidney is the seat of an extensive inflammatory process that involves particularly the parenchyma of its upper half. Here there are the typical lesions of pyelonephritis with streaks of purulent matter arranged in the typical triangular or pyramidal fashion extending toward and reaching the capsule. The capsule itself is enormously thickened, œdematous and hard, separating the parenchyma from thick masses of perirenal inflammatory fat. The pelvis of the upper portion of the kidney is slightly dilated, thickened and inflamed, and harbors two calculi, which almost completely fill the ureteropelvic junction, and the distal portion of the pelvis. These measure about one and one-half inches in length by one and one-fourth inches in diameter.

The lower normal portion of the kidney occupying the lower pole is provided with a small pelvis that leads into the lower ureter, both being practically normal.

The patient made an uninterrupted recovery,

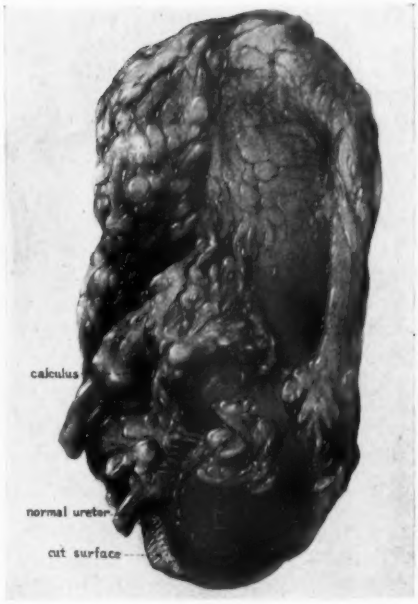

Fig. 3. Deposition of inflamed fat about the upper two-thirds of the kidney; enlarged upper ureter; normal lower ureter; normal lower pole, with cut surface through the isthmus.

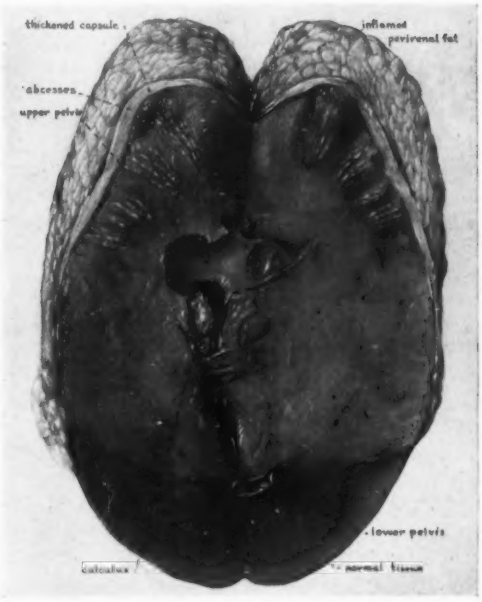

Fig. 4. Kidney bisected, showing perirenal inflammatory fat, two stones in upper pelvis, with multiple abscesses, inflamed œdematous upper three-fourths of parenchyma and normal lower pole.

his general condition improving immediately, so that he was up and about on the twelfth day, and ready to leave the hospital during the third week after the operation.

CLINICAL DEDUCTIONS

A consideration of this most instructive case will disclose points of interest on the interpretation of clinical symptoms, concerning the application of cystoscopic diagnosis, regarding the importance of combined X-ray and cystoscopic methods, and finally about the technique of nephrectomy, when cases of this sort are subjected to operative intervention.

1. *The interpretation of the clinical symptoms.* Very illuminating in this case was the association of attacks of fever with evidences of infection of one kidney without, however, the presence of any localizing sign either in the form of spontaneous pain or local tenderness. At one time even the absence of a large kidney was noted, and it was not until later in the course of the disease that the left kidney became appreciably enlarged and palpable. That such attacks of fever without localizing signs can give cause for anxiety on the part of the clinician is very evident, particularly so, if a thorough investigation of the urinary tract is not carried out. Thus, in the absence of a cystoscopic and roentgenographic examination with the mere presence of pus in the urine, it can be readily understood how the kidney, as a causative factor, in the production of the clinical picture, could be overlooked. In the explanation of the absence of costovertebral tenderness or pain, we may suggest the following hypothesis: that, because of the enormous production of perirenal fat, and of the encasement of the infected portion of the kidney in a mass of inflamed fatty tissue and connective tissue, the inflammatory process was, as it were, encapsulated and prevented from producing fresh exacerbations of perirenal inflammation. It appears that only thus could we explain the absence of localizing pain. Then, too, the absence of

any considerable retention of secretion in the pelvis of the kidney could be held accountable for the dearth of symptoms. We are warranted, in concluding, therefore, that if the cystoscopic and X-ray findings definitely point to the existence of a severe or well-marked renal infection, the absence of local pain suggests, at least, the possibility of such an encasement of the inflammatory focus as was present in this case.

2. *The application of the cystoscopic method of diagnosis.* Here, par excellence, we had a case in which value of careful cystoscopy both in studying the indications for operation, as well as in making an exact anatomical diagnosis of the existing conditions, was well exemplified. Thus, it enabled us to make a diagnosis of the existence of two ureters, to determine that only one pelvis was infected, to decide as to which pelvis was infected, the upper or lower, by these means acquiring valuable suggestions as to the manipulations necessary at the time of operation.

3. *The importance of combined cystoscopic and X-ray examination.* Since the study of renal and ureteral anomalies teaches us that in the presence of a double ureter with duplication or bifurcation of the pelvis, we must be suspicious of the presence of a fused or horseshoe type kidney, it is important to know not only the course of the duplicated ureter, but also to be able to trace the path of the normal ureter with a view to deciding as to whether it leads into a normal kidney over a normal path, or whether it takes a more mesial course where it might be injured at the time of operation.

We may anticipate by saying that it is advisable in all operative cases where three ureters are present to outline these with shadowgraph catheters, and to attempt by good roentgenograms to demonstrate the existence of a renal shadow on the supposedly healthy side, in order to determine whether this is sufficiently large to permit of nephrectomy of the diseased organ, should such procedure be indicated.

Thus, the two ureters on the one side may not take a parallel course, but one of these may cross over the spinal column and lead into the other supposedly healthy kidney, a fact which is important to know. Second, there may be only one kidney present, a fused kidney, the ureters having their vesical orifices in their normal position, or third there may be a solitary kidney with all three ureters leading into one possibly elongated, but unilateral mass. Hence, the importance of visualizing a renal shadow on each side, as well as of outlining the ureters.

The demonstration of the path of the healthy or normal ureter is equally valuable for two reasons: first, because it may be impossible on account of the stoutness of the patient to obtain a satisfactory outline of the supposedly healthy kidney; and, second, because we might very easily injure the ureter of the healthy organ were it to take an abnormal course and traverse the lumbar column dangerously near the field of operation.

In short, in every case of three ureters, requiring operative intervention on one kidney, it is advisable to demonstrate the course of the three ureters by means of shadowgraph catheters. Such plates are of more value when there are three ureters than when there are four, because in the case of four ureters a symmetrical disposition is more likely than in the case of three. In a case of four ureters we may expect two on each side leading into discrete kidneys with double pelves, or two ureters on each side leading into symmetrically placed portions of a fused or horseshoe kidney. It is in the cases of three ureters that chances of asymmetry are greater, and that the course of the third or normal ureter needs visualization.

4. *The value of demonstrating the shadow of the healthy kidney.* Not only may this suggest or rule out horseshoe kidney, but it may also give us valuable information as to the size of the organ, and therefore, some indication of its functional capacity.

A normal or enlarged renal outline, attended with a normal urinary secretion (as evidenced by ureteral catheterization), means that the chances for recovery, in the event of nephrectomy of the other organ, are better; it means in all probability that adequate parenchyma for sustaining life is present, and it indicates that a severance of an isthmus—

in the event of renal fusion—would be a relatively easy matter.

SUMMARY

The following instructive points may be learned from a study of our case:

1. That when a large calculus lies in the bladder, catheterization of both ureters may be possible, particularly if the stone be pushed aside by means of the beak of the cystoscope, but that a double ureter on one or the other side may be overlooked, the posterior or upper one being covered by the calculus.

2. That infection may occur in one of the pelves of a kidney with ureteral duplication, without involving the parenchyma corresponding to the other pelvis.

3. That cystoscopic diagnosis is of great importance, even though the X-ray examination may show a calculus, for it permits of an exact anatomical diagnosis, and enables us to diagnosticate a double pelvis and ureter, if such be present, giving us thereby valuable hints as to the technique of nephrectomy.

4. That the presence of a ureteral and pelvic duplication should make us suspect the existence of a fused kidney, although such cannot always be diagnosticated with certainty.

5. That a knowledge of the possible presence of a fused kidney at time of nephrectomy is important, in that it not only suggests to us the search for the existence of a connection isthmus, but also induces us to avoid injuring the ureter of the other kidney.

6. That whenever a double pelvis is present with two ureters, it is interesting not only to outline these two by means of the shadowgraph catheter, but also to obtain by means of the shadowgraph catheter an outline of the third ureter, and if possible, to obtain a shadow of the normal kidney. The outline of the two ureters on the one side helps us in the technique of nephrectomy, and the course of the normal ureter is of importance to us in that it spells safety for us if its course is normal, whereas, it should be dealt with with great care, if the normal ureter be situated far mesial or overlying the isthmus of a horseshoe or fused organ.

7. That the occurrence of attacks of fever, sometimes with chills, means pyelonephritis and multiple abscesses, in the absence of evidences of marked retention of urine in the kidney.

8. That the absence of local, lumbar or costovertebral tenderness in a case of pyuria with attacks of fever and chills, with cystoscopic evidences of unilateral renal infection does not mean an absence of severe renal infection, but that it indicates an associated *intense perinephritis* with enough fat production to form a large massive shell about the infected kidney, the suppurating parenchyma being walled off thereby to such an extent that the usual symptoms do not manifest themselves.

THE EXTREME PENDULOUS ABDOMEN AND ITS SURGICAL TREATMENT BY A NEW THREE-FLAP OPERATION

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THE surgical treatment of the pendulous abdomen is still in the evolutionary stage. One looks in vain for any reference to this subject in the ordinary textbooks and but very brief mention is made in the more exhaustive systems of surgery, though many excellent articles by Alexius McGlannan, Cullen, Wayne Babcock, and others have appeared in the recent issues of the surgical journals. Especial mention should be made of the work of Blake in developing the double flap operation, and of W. J. Mayo's operation for umbilical hernia, both procedures having their places in the treatment of some of the less marked types of the condition under discussion. Pendulous abdomen is usually seen in women who have gone through repeated pregnancies, and in whom the panniculus adiposus is especially well developed. Modern methods of dress which tend to displace the abdominal viscera into the lower abdomen rather than giving support thereto tend to aggravate the condition.

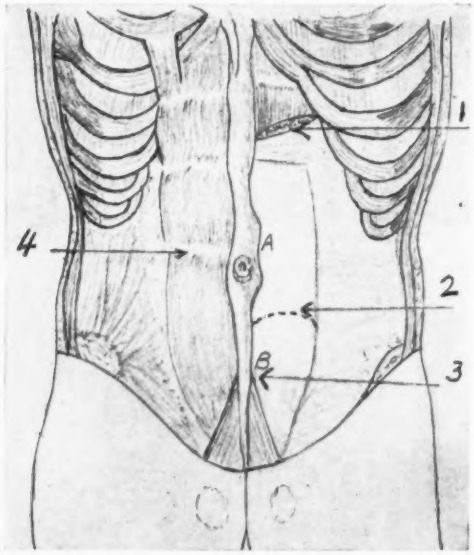

Fig. 1. Between the points *A* and *B* the linea alba yields most to increased intra-abdominal pressure. *1*, Rectus abdominis cut across; *2*, semilunar fold of Douglas; *3*, point above pubis where linea alba is reinforced by the pyramidals abdomines and triangular fascia.

ANATOMICAL CONSIDERATIONS AND PATHOLOGICAL ANATOMY

Anatomical reasons for the condition are found in the arrangement of the aponeurosis of the linea alba. From one and one-half to two inches above the symphysis pubes where the recti muscles decussate and are reinforced by the triangular fascia of the abdomen and the pyramidales muscles, the wall at this point is extremely strong. In no case was the stretching of the linea alba found to have passed below this point. Again at a point immediately above the umbilicus the linea alba appears to be very dense and unyielding. In all the cases observed, a well defined line of demarcation existed between the stretched part and the part above the umbilicus which had not given way. This point appears to be at the lowest linea transverse of the recti muscles, and is situated just above the umbilicus. The point of

Fig. 2. Pendulous fat. Abdominal wall not relaxed.

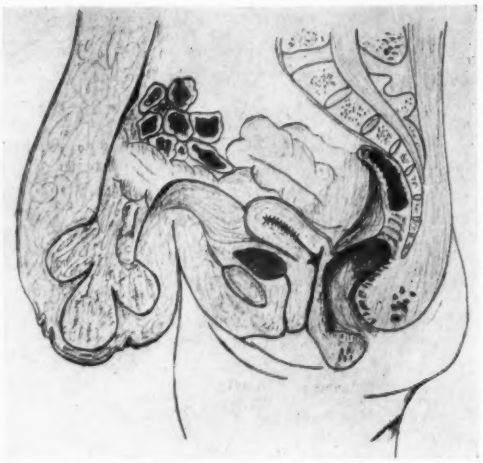

Fig. 3. Extreme pendulous abdomen with umbilical hernia. The umbilicus forming the apex of the protrusion.

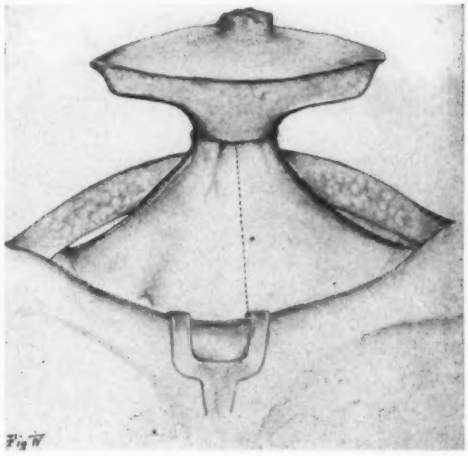

Fig. 4. Elliptical incision. Fat dissected from external oblique aponeurosis, relaxed abdominal wall lifted up in form of a cone.

maximum lateral stretching in all the cases seen by me was at the semilunar folds of Douglas. The recti muscles are displaced, and while in some cases somewhat attenuated, do not enter into the parts that have given way.

According to Cunningham[1] the umbilicus is situated normally below the mid-point between the infrasternal notch and the symphysis pubes. It is opposite the fourth lumbar vertebra. In most of the cases referred to in this article it was opposite or below the symphysis pubes.

If an opening is made at the umbilicus and the hand inserted into the abdomen of one of these huge pendulous cases, a definite internal ring can be felt which might be compared to the internal ring of an ordinary hernia. This ring is bounded laterally by the margins of the recti muscles, below by the point of decussation of the recti

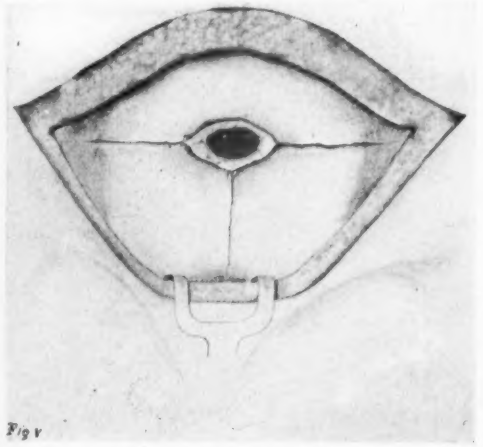

Fig. 5. Two lateral incisions and one vertical incision are made forming three flaps.

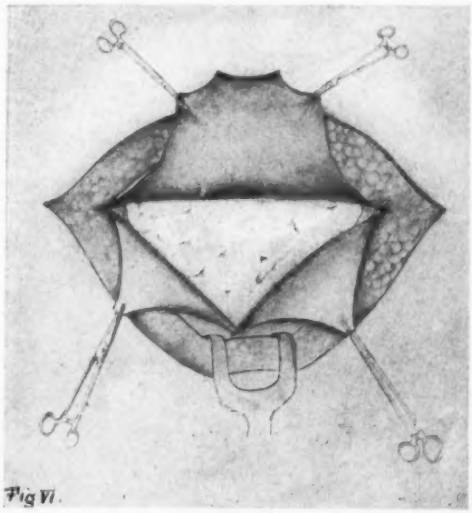

Fig. 6. The three flaps are here shown ready for stitching.

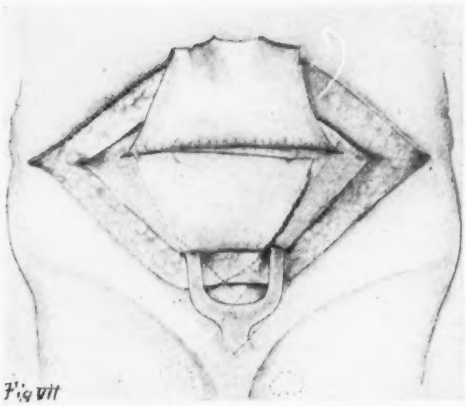

Fig. 7. The two lower flaps are overlapped and stitched, their upper double margin being stitched to upper margin of internal ring.

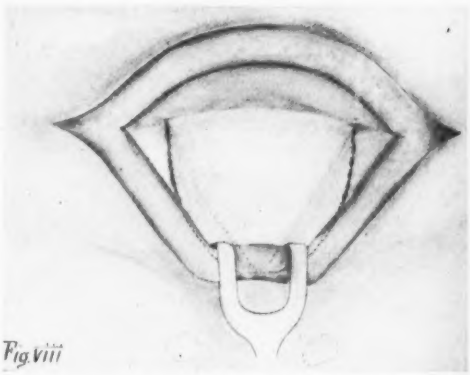

Fig. 8. Upper flap brought down over the lower, the double flap, and stitched to the external oblique apo neurosis.

muscles about one and one-half inches above the pubes, and above by the margin of the linea alba which has not yielded to the stretching corresponding to the lower linea transversa of the recti muscles.

It will therefore be seen that while at first sight the stretching of the structures appears to be universal to the whole anterior abdominal wall, it is entirely limited to a definite area. This area in the normal anatomy corresponds to a narrow line, the linea alba and that part of it lying between a point very little above the umbilicus and a point about one and a half or two inches above the symphysis pubes (Fig. 1).

SURGICAL TREATMENT

Surgical treatment should not be lightly undertaken and is called for only when the condition is causing troublesome symptoms. The operative mortality has been high in this type of patient. McGlannan (2) places it at 6 per cent for massive non-strangulated, and 50 per cent for massive strangulated hernias. These figures only convey a relative idea of the mortality, for we do not know what type of operation was done, or whether anything was done beyond a simple umbilical hernia operation without any attempt at reducing the protruding abdominal wall. The cases becoming obstructed must necessarily be those associated with an umbilical hernia, as obviously it would be difficult to have an obstruction in a pendulous abdomen not accompanied by an umbilical hernia.

The preparation of the patient for operation in these cases is most important for two reasons: first because the intra-abdominal pressure should be reduced to a minimum, and second, the skin, which is moist and foul from intertrigo, must be cleansed and purified. For a week or ten days the patient should be put on purgation, and a very restricted diet. Daily warm baths should be given and alcohol applied to the skin of the abdomen. A folded sterile towel should be placed between the overhanging abdomen and the pubes and kept in place by a narrow binder or bandage

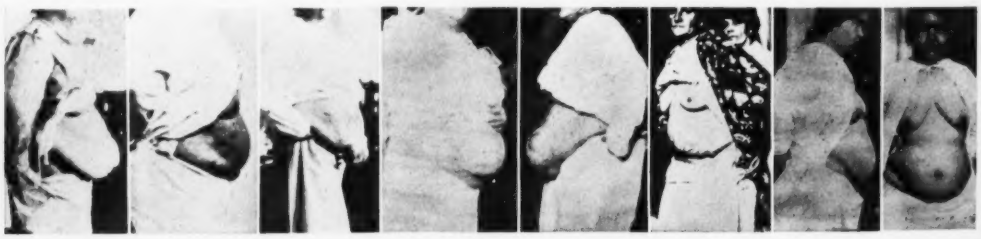

Fig. 9. Case 1. Fig. 10. Case 2. Fig. 11. Case 3. Fig. 12. Case 7.

which falls into the crease and over which the towel folds. This should be worn during the preparation to prevent the two skin surfaces coming in contact with each other.

Operation. The pendulous abdomen due entirely to an abnormal development of the panniculus adiposus where the muscular and aponeurotic structures are normal (Fig. 2) rarely calls for treatment, and if it does, a simple lipectomy is all that is necessary.

In one case referred to me by Dr. H. P. H. Galloway, suffering from sacro-iliac strain, a lipectomy was done to facilitate the fitting of an orthopedic apparatus for the support of the strained sacro-iliac joints. This type of pendulous abdomen may be associated with an umbilical hernia, in which case a Mayo operation combined with a lipectomy is indicated. These types are not to be confused with the type of extreme pendulous abdomen where there is marked diastasis of the recti muscles and where the linea alba is greatly stretched. Their recognition and differentiation should not be difficult.

The following procedure which I have named the three-flap operation, is, I believe, the method of choice when operative treatment is undertaken in the case of extreme pendulous abdomen (Fig. 3). Two long incisions forming an ellipse are made from one side of the abdomen to the other, the upper passing above the umbilicus, the lower passing about two inches above the fold where the abdomen hangs over the pubes. The skin and fat are dissected away from the external oblique aponeurosis until the ring of the umbilicus is met (Fig. 4). The abdomen is then opened at the umbilicus, and the mass dissected away from the umbilical ring. Great care must be taken at this point as the umbilicus is often dilated into a multilocular sac and the contained omentum and intestines are often adherent. It will now be found that the part of the abdominal wall which has given way can be lifted up in the form of a cone with the umbilicus forming the apex (Fig. 4). If the fingers be inserted within this cone the internal ring already described can be felt at its base.

It will serve the purpose for the convenience of description to call this the internal ring of the protrusion. The upper limits of the ring while several inches from the umbilicus in the pendulous abdomen cases, is a point very close to the normal anatomical position of the umbilicus and, as already mentioned, corresponds to the lowest lineæ transversæ of the recti muscles.

Two lateral incisions are now made from the umbilical ring to the inner margins of the recti muscles. A third incision is made from the umbilical ring downward to the firm lower margin of the internal ring, the point already described where the recti muscles decussate (Fig. 5). Three flaps are thus formed, two lower and one upper (Fig. 6). The two lower flaps are overlapped from side to side thus reducing by one-half the space between the recti muscles. The free margin of each flap is stitched with strong chromic catgut to the firm margin of the sheath of the opposite rectus muscle. The upper flap is now drawn upward, and the upper margin of this lower and now double flap is stitched to the upper margin of the so-called internal ring (Fig. 7). The upper flap is next drawn downward and spread over the lower double flap and its margin stitched to the aponeurosis of the external oblique (Fig. 8).

It was found in my series of cases, that in all, the lower margin of this upper flap reached the point below which no stretching had taken place. The skin is closed, and three small tube drains are inserted, one at each angle and one in the center of the wound. It will be seen that in the place of the relaxed wall we have now a three-fold aponeurosis covering the opening and secured at every point to normal anatomical structures that have not yielded to the intra-abdominal pressure.

CASE 1. Mrs. N., age 49, mother of a large family, had an umbilical hernia more than ten years. It has been gradually enlarging and the abdomen has been growing pendulous.

Operation, 1913. A large elliptical incision was made from side to side. A mass of fat weighing 7 pounds was removed with umbilicus which was multilocular. The great omentum was adherent. Three-flap operation performed. Recovery normal. Result excellent. Patient seen in 1917, and condition still excellent.

CASE 2. Mrs. H., age 53, mother of several children, has had an umbilical hernia and pendulous abdomen for a number of years. Operation, 1914. Transverse lipectomy. Fat and umbilicus removed weighing 7¾ pounds. Three-flap operation. Recovery normal. Patient seen in 1917. Has a small inguinal hernia (bubonocele) right side. Abdomen in excellent condition.

CASE 3. Mrs. S., age 43, eight children, first noticed small swelling at navel fifteen years ago during pregnancy. The patient has suffered from constipation, pain and vomiting, which was diagnosed as attacks of acute obstruction.

Operation, January, 1916. Lipectomy, removal of umbilicus, which was very large and multilocular. It contained the lower part of ilium, cæcum and appendix, ascending colon, hepatic flexure and part of transverse colon and great omentum. The appendix was very large and markedly inflamed. The intestines and omentum showed recent inflammatory adhesions, undoubtedly due to peritonitis from the acutely inflamed appendix. Recovery was normal.

CASE 4. Mrs. D., age 44. (I am including this case in this series, though strictly speaking, it belongs to another class.) The patient had a large incisional hernia with a

large amount of pendulous fat. The hernia followed an operation for removal of inflamed adnexa from the pelvis which necessitated drainage. Though she had one week of preparation before operation for the hernia, she did not escape what we most dread in these cases — infection.

Operation, March, 1916. Lipectomy with reclosure of the hernia by overlapping. The center skin drain discharged a greenish serum. Culture showed streptococcus. The patient died on the fifth day from peritonitis.

CASE 5. Mrs. T., age 48, mother of eight children. After last child six years ago, noticed a swelling at the navel. This has gradually enlarged.

Operation, June, 1916. Lipectomy and three flap operation. Recovery normal. Result excellent.

CASE 6. Mrs. C., age 46, mother of several children. Some years before had an operation which was followed by an incisional hernia. The abdomen was pendulous, though the umbilicus was normal and not displaced. This did not seem to be a case for a three-flap operation. However, in trying to suit the procedure to the condition, it was found that the three-flap method filled the indications most perfectly. Recovery was normal, except that a superficial infection occurred and discharged from the center drain which delayed convalescence.

CASE 8. Mrs. S. No pregnancy. Patient had a small umbilical hernia and pendulous abdominal fat. No relaxation of abdominal wall. This is a case of the type represented in Fig. 2.

Operation. Lipectomy and Mayo operation for umbilical hernia.

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1. CUNNINGHAM. Textbook of Anatomy, sec. iv, p. 1264.
2. MCGLANNAN, ALEXIUS. Massive umbilical and ventral hernias. Surg., Gynec. & Obst., 1915, xx, 700.

BOOKS RECEIVED

Books received are acknowledged in this department and such acknowledgement must be regarded as a sufficient return for the courtesy of the sender. Selections will be made for review in the interests of our readers and as space permit.

SURGICAL TREATMENT. A Practical Treatise on the Therapy of Surgical Diseases; for the use of practitioners and students of surgery. By James P. Warbasse, M.D. Philadelphia and London: W. B. Saunders Company, 1918.

A COMPEND OF GENITO-URINARY DISEASES AND SYPHILIS. Including their Surgery and Treatment. By Charles S. Hirsch, M.D. 3d ed., revised. Philadelphia: P. Blakiston's Son & Co., 1918.

MASSAGE AND THE ORIGINAL SWEDISH MOVEMENTS; their Application to Various Diseases of the Body. By Kurre W. Ostrom. 8th ed., revised and enlarged. Philadelphia: P. Blakiston's Son & Co., 1918.

PAPER WORK OF THE MEDICAL DEPARTMENT OF THE UNITED STATES ARMY; a guide for administrative work. By Ralph W. Webster, M.D., Ph.D. Philadelphia: P. Blakiston's Son & Co., 1918.

EQUILIBRIUM AND VERTIGO. By Isaac H. Jones, M.A., M.D. With an analysis of pathologic cases. By Lewis Fisher, M.D. Philadelphia and London: J. B. Lippincott Company, 1918.

THE SURGICAL CLINICS OF CHICAGO. Vol. ii, No. 5 (October, 1918). Philadelphia and London: W. B. Saunders Company, 1918.

LEÇON DE CHIRURGIE DE GUERRE. Published under the direction of Cl. Regaud. By Mm. Guillain, Jeanbrau, Lecène, Lemaitre, Leriche, Magitot, Mocquot, Nogier, Okinczyc, Piollet, Policard, Roux-Berger, Tissier. Paris: Masson et Cie, 1918.

THE OXFORD MEDICINE. Advance Pages. Edited by Henry A. Christian and Sir James Mackenzie. Vol. i, part i. New York: Oxford University Press, American Branch, 1918.

NEOPLASTIC DISEASES; a Textbook on Tumors. By James Ewing, A.M., M.D., Sc.D. Philadelphia and London: W. B. Saunders Company, 1919.

THE PRINCIPLES AND PRACTICE OF OBSTETRICS. By Joseph B. DeLee, A.M., M.D. 3d ed. thoroughly revised. Philadelphia and London: W. B. Saunders Company, 1918.

A MANUAL OF GYNECOLOGY. By John Cooke Hirst, M.D. Philadelphia and London: W. B. Saunders Company, 1918.

AMERICAN COLLEGE OF SURGEONS

CASE RECORDS AND THEIR USE

IN RELATION TO HOSPITAL SUCCESS

TO create grim earnestness among hospitals in the matter of case records and to indicate the relation of case records to good hospital service are the purposes of these pages. The sheets or record-forms described in the following pages are published simultaneously by the College in Bulletin No. 2, Vol. IV. The sole object in issuing these two bulletins is to make for the better practice of medicine; and whatever value they may present toward this end springs from the good co-operation of the hospitals with the College in its program of hospital standardization.

The keeping of case records in hospitals came about in a natural fashion. Long ago, as the practice of medicine developed into a profession, the more competent and conscientious practitioners made notes for themselves as to the physical condition of their various patients and as to what they did for their patients. These notes were aids to the memories of the doctors who made them, and a guide for other doctors when similar cases presented; they were an effort in the interest of the patient. Then by very swift degrees medicine became a more complex and exact science and the need for notes or records in clinical practice became more imperative; and as this process went on and great strides forward occurred in medical science like the discovery of bacteria, anæsthesia, and asepsis, there came a quick development of hospitals with their cleanliness, their laboratories, their X-ray apparatus, their dietitians, their trained nurses, and their case records. All of these advances are to aid the doctor in the care of his patients.

The whole story of hospitals is one of natural evolution. Today the hospital is in a striking period of transition, changing from the kindly-disposed boarding house for sick people, which met a genuine need in its day, to the institution worth while on its own account, rendering service to the sick for which it assumes responsibility. In other words, the modern hospital is an institution where not only the competent study and treatment of sick people *may* occur, but where, also, the competent study and treatment of every man, woman, and child who enters its service as a patient *do* occur as a matter of clear-cut institutional policy.

The remarkable success in recent years, financially and otherwise, of the comparatively few hospitals which have instituted and carried forward this policy indicates the lines of hospital advancement during at least the next decade. The reasons for the success of these hospitals are the quick appreciation and gratitude on the part of the public for the service rendered and the resultant bonds of confidence created between these hospitals and their communities. The wholesome factor of competition means among hospitals, as among individuals or among nations, that success and prosperity will come where due on the basis of merit.

TEST OF MEDICAL PATRIOTISM

But to return now to case records: First, what are these records? Second, what element are the records in the success of a hospital?

First, case records are an orderly and written statement of the complaint of the patient, of the findings as to the physical and mental condition of the patient, of the treatment,

EXPLANATORY NOTE.—Better health through better hospitals is the object of the series of hospital conferences arranged by the American College of Surgeons the first of which is to be held at Kansas City early in February. The Fellows of the College, the medical profession, hospital superintendents and hospital trustees are invited to these conferences each one of which covers from one to five states. In order to bring effective attention to bear upon the chief needs of hospitals and the practice of medicine, the College, in addition to the calling of the conferences, is publishing a series of hospital bulletins. The first two of these are just issued and the following pages are taken from one of them entitled, "Case Records and Their Use."

medical and surgical, of the complications, if any, and of the final results.

Second, as to the relation of case records to the success of the hospital: If case records are essential to good hospital service, just why are they essential?

In answer to this question let us keep vividly in mind that the hospital exists for the patient. Let us assume that the hospital seeks to give worthy service to every man, woman, and child admitted to its care; that in return it seeks the confidence and good-will, and even the financial aid of its community. If these conditions are true, it follows that the hospital creates an equation which consists of service to the sick on its own part, balanced by proportionate and practical gratitude for that service on the part of the public. The next and inevitable step is that the truth of the equation be sharply tested. Rational and convincing evidence as to the hospital's service is wanted by the public, and not general or sentimental optimism. In other words, because of its very importance, the hospital is under fire of criticism. In some practical fashion it must account for efficient performance in every department. It must account for the ability and in some measure for the moral worth of the doctors privileged to practice within its walls; for the completeness and dependability of its laboratory reports, including the X-ray; for the faithfulness and intelligence of its superintendent, its internes, and its nurses; and for the strength of all of these to work together in single purposefulness. How shall the hospital make this accounting? Well, results are what count and the results are to be found in case records.

The first practical reason, therefore, as here stated for the keeping of case records is that these records are a pledge of loyalty of service on the part of the hospital to its community. For example, a patient comes to the hospital, a diagnosis of appendicitis is made, the patient is operated upon and dies; unless an accurate record of the case has been kept showing the hopeless state of the patient and what was done for him, how can either the hospital or the surgeon justify a death from simple appendicitis?

CASE RECORDS IN ARMY HOSPITALS

The relation of the army hospitals since the beginning of the Great War to the people of this country is an excellent illustration in point. The officers of the medical department of the United States Army realized at the outset that the Surgeon General's office was accountable to the entire nation for the treatment of each soldier admitted to sick report. They realized that each soldier was, in case of sickness, entitled to the best service known to the science of medicine; they realized that the people of the nation were entitled to exact evidence that the sick soldier received such care. The report just issued by the Surgeon General to the Secretary of War for the year ending June 30, 1918, is a monument in the history of medicine for its effect on the civil practice of medicine. The Surgeon General in this report has presented in an intelligible fashion the exact facts as to the care and treatment of soldiers in the army hospitals. The entire report is based upon data taken from the individual case records of the soldiers. These records for each patient were written under strict military orders, and not only was the completeness of the records checked up constantly through the Surgeon General's office, but the character of intelligence displayed by the medical officers through these records was also constantly held up to critical review.

Space does not permit here an analysis of the Surgeon General's report. But the question may fairly be asked as to whether or not the civilian hospital is not quite as much obligated to report the character of its work to its community as are the army hospitals to report to the Secretary of War and through the Secretary to the public. There is but one basis on which such report may be made and that is from properly kept case records.

To illustrate again, let us suppose that a workman enters a hospital and learns that he needs an operation for hernia. Is it not reasonable that he should ask: "Based on your figures for other cases like mine during the past year, what chances have I to be at work again after the operation?" The question is of importance to the workman. Can the hospital answer it? Can the staff and officers

claim with easy conscience that they protect the welfare of this man by every safeguard known to medical science? If so, how can they prove the claim? Or is the best of service too good for this man?

Facts, facts, — facts in the relevant personal history of each case, facts developed in the physical findings, facts brought to light by the laboratories and the X-ray, facts deduced through pliable wisdom from all of these and expressed as diagnoses, — these are the foundation of the hospital. And unless the hospital as a matter of institutional policy is in possession of these facts, filed in an orderly fashion in justification of its work, it is entitled to little credit in its community or in the medical profession. To repeat, the character of the case records is a test of the hospital's loyalty to service.

In taking the position here that the hospital is a public service corporation and that as such it is accountable, the question of ownership or of control is not raised. It is immaterial whether the hospital is municipal, state, or private. The contention here is simply that every hospital is a public service institution just as a college is a public service institution. Columbia University, for example, is a privately endowed university controlled by a self-perpetuating board of trustees. In a broad sense, however, Columbia considers herself a public service institution. It makes an annual accounting to the public for the expenditure of all of its funds; it states clearly at frequent intervals its various aims; and it analyzes its efforts to fulfill its aims. It states facts. Through the result of this policy and the wisdom of carrying it out, Columbia stands in an exalted position throughout the world. Millions of dollars go to it unsought because it has won and merited public confidence.

CHECK UPON CHARACTER OF SERVICE

Emphasis in the foregoing paragraphs has been placed upon case records as a test of medical honesty, or let us call it medical patriotism. A second and quite as significant a reason for these records lies in their use to prevent or minimize errors in all clinical practice; to serve as a direct test of efficiency.

Medicine in its application to the needs of the human body is both an art and a science. It can never be reduced to the simplicity or to the certainty that two and two are four. The variable factor of judgment and variations in individual patients is always present. Case records, if wisely kept, offer an invaluable means to the hospital staff to profit constantly by its own experience in practice. This phase of record keeping was especially emphasized by the College in the announcement of its first hospital survey; and in this connection the use of a summary card to make available for study and review the important data of the records was urged. But just how as a practical problem of administration are case records to be used as a test of efficiency? This question leads to a consideration of staff meetings.

WHY MEETINGS OF HOSPITAL STAFF?

The whole scheme of the universe is organization. If you pick up a gosling in the orchard, the flock of geese will attack you; you will learn a practical lesson about organization and about co-operation. The stone men hunted the mammoth together. Our early pioneers built block-houses wherein whole communities could gather and protect themselves from Indians. The building of towns, whether they be towns of people or towns of squirrels or of prairie dogs, is predicated on community action and on organization.

The individual doctor in the hospital can usually accomplish very little single-handed. But working together, all of the doctors or the staff can accomplish almost any right thing which they set out to do. Their business then is to get together, to agree upon what they want, and to turn wishes into action.

Doctors want good service for their patients. Now the staff meeting is the means for the doctors to get together. It is the occasion, for example, at which they will find out the extent of seemingly unnecessary infection among surgical cases in the hospital, the character of these infections, and the causes of them. Almost any problem which will present itself to the staff is related directly or indirectly to the case records. Certainly the

number of septic cases, the character of the infections, and the probable causes of the infections will be recorded in an adequate record system.

But harmony of purpose at staff meetings and clinical facts are not alone enough. The meetings must be an assembling of live people to discuss live subjects for a definite purpose. Each meeting must "get somewhere."

"Are we having unnecessary infections in the surgical service?" asks the head of the surgical department at the staff meeting. Certainly it is his business to know the answer to this question; and in a broad sense it is the business of every member of the staff to know the answer to this question. What are the facts? Where are the infections coming from, if they exist? Whose cases are they? What or who is to blame? Is it the operating room sterilization, or dressing room uncleanliness, or water infection, or is the doctor himself to blame? Open and frank discussion of such topics will lead to action and do more for a hospital than anything else.

But let us not assume that the staff meeting is to develop into a scolding bureau. Let us rather assume that every man and every woman is doing his and her level best to get good results, and that the only sure way to get these results is to talk about the failures. More can usually be accomplished by recognition of merit, kindly expressed, than by scolding.

Again, let us suppose that the medical service is up for review. Is everything going well there? Is the dietary in good hands? Is the nursing happy, conscientious, and adequate? Are patients given the individual attention they need? Is the hospital clean? Is the air kept pure? Is the humidity right in the wards and in the rooms? Has each case received due and prompt study, aided by competent laboratory reports?

Is there any reason why such subjects as these should not be discussed by the staff with freedom, warmth, and candor? Will not such discussion increase manyfold the efficiency of the hospital?

Again, the staff may consider the material equipment of the hospital. Is there the necessary apparatus, let us say, in the examining room? Let us suppose that there is not and that the superintendent says that he has not the money to buy the apparatus. If the superintendent reports lack of funds to one doctor, the chances are that the doctor will accept the report and let it go at that; but if the superintendent reports to the staff, the staff should not and will not be casually put off. It will insist upon its need and effectively lay the responsibility upon the trustees. It will win.

Is there co-ordination between the departments of the hospital, and co-operation between individuals? Is there team-work? If not, the hospital will fail, for success and team-work live together. It takes harmony in all departments and between all departments to spell hospital success. To establish the habit of frankness in talking about these things at staff meetings will do much to create harmony.

There will be times when the trustees should be present at staff meetings to listen to wholesome truths about the hospital and about themselves and about individual members of the staff. More good can be done in five minutes' talk with the trustees in this way than can be done in a whole year of talk behind the backs of trustees.

How often ought staff meetings to be held? Often enough to keep up the active interest in the work of the institution; often enough to keep the staff members talking about hospital progress from meeting to meeting; not often enough to cause the meetings to be a burden to busy doctors. One evening a week ought not to be too much to ask of every man on the staff of a hospital to spend at staff meetings.

The objection is sometimes raised that "the staff won't come." If this is true, why "won't" the staff come? The real answer is perhaps that the meetings are perfunctory, uninteresting, deadly monotonous, and uninstructive. If, in addition to the purposes of meeting above described, two or three clinical cases can be shown at each staff meeting, — cases that have been well worked up, the records of which are complete, the resources of the hospital being exhausted to obtain a diagnosis of the disease, and if all these points are brought out by the man whose case is

being shown, and if there is instruction and information, — then the staff meetings will be like meetings to which those same medical men gladly go hundreds of miles to attend.

A staff member does not have to be a star in the medical sky to present a most interesting and instructive case. All he has to do is to have an interesting case and to present the facts marshaled in logical order. Then he will get the interest of his fellows on the staff, and meetings at which this kind of work is done will be popular and productive.

The staff meeting in every hospital ought to be a red-letter day in that institution, and everything in the hospital ought to radiate toward these staff meetings, — criticisms, complaints, and commendation. The staff meetings are the clearing-house of the hospital. The value of these meetings may be briefly summarized:

1. The fostering of great-heartedness, of determination, of courage, and of desire to grow in ability and worth. With right comradeship and purpose, the difficult task becomes the interesting task and excuses for failure give way to action towards success. Too much value cannot be attached to the right spirit of service in a hospital staff; and human nature is such that we need constant sincere interchange with our fellows to keep that spirit at its brightest glow. "Repeat to me every criticism you hear," said Pasteur; "I shall prefer them to praise."

2. The elimination to a practical degree of incompetence, negligence, or laziness in the hospital, first, because the staff meetings serve to stimulate and to inspire each member to his highest effort; and, second, because elements of incompetence, negligence, etc., will become so plain that those who continue guilty will either voluntarily resign from the privileges of practice in the hospital or be requested so to do. All of this means protection to the patient.

3. The internes and the younger men in medicine today will in a brief period become the masters in the profession. The character of their leadership will depend much upon the inspiration gained by example during the early years of their life's work. Fearlessness in seeking truth and evidences of honor which will develop at staff meetings will put into the hands of internes the lights which shall burn after the present masters are gone.

4. Staff meetings in time will be productive of data relative to the treatment of disease which are comparable among hospitals. When the practice of regular staff meetings becomes general among hospitals and when the facts and results of practice are regularly summarized in intelligible form, we shall have a mass of information which will not only lead directly to the advancement of medicine, but which will also create a wholesome rivalry among hospitals and thereby stimulate further progress.

PRACTICAL POINTS ABOUT CASE RECORDS

1. The basis of a good case record is keen native ability, sound training in medicine, and the use of both in the care of a patient. Upon the condition of the patient depends the extent of the record. The record consists only of such facts as will be of worth to the patient in the study and treatment of the case; and to the profession for its information in the treatment of similar cases in the future.

2. Whatever the nature of a serious illness, that illness has a relation to the entire body and, though briefly stated, this relation should be recorded. Novel writing under the guise of case records is a waste of time, energy, and money.

3. The psychology of case records is admirably designed for the prosperity of the hospital. A patient who is convinced that his case has been wisely studied and considered of sufficient importance to be recorded is usually a satisfied patient. A bond at once results from this procedure between the patient and the hospital to their mutual advantage. Sound, complete physical examinations often make unnecessary what seems at first a necessary surgical operation.

4. Insistence upon case records in no way reduces the practice of medicine to a machine-made process. The entire process is human and the records are human documents. They are the sincerity and reality of good work; they are the muffins and not the promise of muffins. Good records have something in them that can be made at no mill. They are

not dull facts recorded as a mere routine. They are the records both of an art and of a science, the whole design of which is shot through with the purpose to prolong life, to relieve suffering, to make life glad and nutritious. They are a chief basis of progress in the medical profession, a means to extend the science of medicine and to make surer medical practice: and when the value of case records is estimated at its true worth, all wavering as to the task of keeping them will end in determination.

5. Who is to be responsible for hospital records? The old saying that everybody's business is nobody's business applies to case records. If the records are worth keeping and if they are worth keeping so that their contents are available for study and review, then somebody must have charge of them; somebody must check them up, see that they are all promptly complete, conveniently accessible, and protected from misuse. In a small institution, not oversupplied with funds, it may be wise to double up on duties in this matter. The person who keeps the records may also have other things to do, perhaps in the receiving room, or in the bookkeeping department. But in a hospital of considerable size and especially in a hospital of great earnestness, the records are the sole responsibility of one person.

Supervision of records usually falls to a woman; and if the woman is competent, it may be understood at the outset that she will not be popular for a long time at least with those for whom she works. She will be a nagger and a nuisance to those who are indisposed to keep up to the hour with their records. She will have to appeal to the doctors, and sometimes appeal over the heads of individual doctors to the staff as a whole. But by insistence upon performance of duty the recordkeeper will ultimately win the hearty good-will of the staff and render also a service mightily worth while.

6. A word about filing records and indexing: If records are useful, they ought to be continually useful, which means that they must be accessible. They cannot be useful if tied in bundles indiscriminately and packed away in the attic or basement.

How are records to be filed? Of course, they must be filed so that any record can be quickly found in good and usable shape. Many methods of filing records have been proposed and tried, but no system has been found that answers better all purposes than the envelope system or the vertical filing system, each record in its own envelope or folder. The patient's name and number appears on the corner of the envelope or folder so that one may readily find any record. The system of binding records in volumes meets with little approval in practice. The volumes cannot freely be taken from the library and hence the doctor who wishes to examine the record, especially of a patient who returns to the hospital on a second or subsequent visit, must practically have an abstract made of that record. When a patient comes into a hospital and it develops that he or she has been there before, the new record should be added to the former one. It is not necessary that the record on this last visit should have the same number.

This consideration raises the question of indexing. If there is a librarian at the hospital who has charge of the records, she will make her service most useful by keeping three indices, each in alphabetical order, of the cases as follows: First, an index of the names of the patients; second, an index of the final diagnoses; and, third, an index of the organs affected. Other index entries may also be kept which concern complications.

Records indexed in this way are available for the purposes of the literature. The hospital also can readily find the patient's record where the patient is concerned by name; and for the purposes of the literature the librarian can pick out required records without trouble. If a staff member, for example, is writing on pneumonia, the index shows all of the pneumonias which have occurred in the hospital, including those with pneumonia as a secondary complication. Again, if the doctor is writing about an organ or the diseases of an organ, or is studying some problem incident to a certain organ, all the cases that have ever been in the hospital in which this particular organ was involved can be procured without delay.